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AMERICAN MACHINIST

April 3, 1940

Photo courtesy Westinghouse

Smooth—*But how good is it? In judging surface quality, smoothness isn't everything*

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Houston, Texas

"... the advertising in *American Machinist* is my first-choice reading material ..."

WHAT'S IN THIS ISSUE

GLITTER

By looking southeast and slightly up, on any but the foggiest of days, we can feast our eyes on one of the vastest expanses of stainless steel ever assembled—the glittering trim of the Empire State Building. Since we first caught sight of it, we've become accustomed to seeing more and more stainless everywhere we look. Restaurant fittings. Automobile decorations. Home knicknacks. But always in the form of sheet metal.

The reason, of course, is the eye appeal stainless steel sheets can give a product. It took some time for designers to appreciate the physical and chemical properties of this material and begin specifying it for machine parts. But it was only a question of time, and now much machinery, including many units far out of sight (and presumably out of mind), are being made of this material.

It's no news to you that machining stainless — especially on automatic equipment—involves problems of its own. For that reason, many shops shy away from it. But the trick is all in knowing how. Crown Cork & Seal, a company that makes a lot of bottling equipment, turns out hundreds of stainless parts in automatics. And with a finish comparable to that on polished sheets. They're the first to admit it took some time to learn how. But what they've learned they gladly pass along in the article beginning on page 195.

ON THE SURFACE

Speaking of finish, exactly what do you mean when you say a part has a high finish? What is the relationship between type of finish and surface quality? And how can these values be measured, so that accurate duplication or conformation to specifications can be obtained? H. J. Wills, of the Carborundum Company, explains the various methods of determining surface quality, suggests standards, and crashes through with a really definitive answer to the question, "What *is* surface quality?" You'll find it on page 199.

HOT PLATE

In pressing plates for freight car ends, best results are obtained when they are first heated to accurately controlled temperatures. Since they are of considerable size and weight it isn't the easiest job in the world. But Union Metal Products Division of Standard Railway Equipment Manufacturing Company does it without much trouble. On page 201 plant superintendent W. J. Tangerman tells the part automatic equipment plays.

FLASH!

You've been reading a lot lately about Canada's preparations for war. But you haven't seen any pictures. The reason: The censor said no. But if you'll turn to page 209 of this issue of AMERICAN MACHINIST, you'll find three pages of the very first pictures ever to come out of Canada showing detailed operations in munitions plants.

RUBBER STAMP

"What has hydraulic qualities but is not hydraulic?" was one of the questions Henry Guerin asked himself when trying to figure out a better way to blank and form sheet metal. And in the answer to that very question lay one of the few brand-new ideas in metal-working. Today the Guerin Process, as it has come to be known, is rapidly making history in aircraft plants the world over. For producing parts in small quantities it's the answer to many a production man's prayer. Just how the new process works, and how it came to be, Mr. Guerin tells in his own words beginning on page 206. As both factory manager of Douglas Aircraft and inventor of the process he's in a rare position to give the lowdown on it.

H. J. WILLS

HENRY E. GUERIN

DEEP

Drilling deep holes in a material like steel is no easy job no matter how you tackle it. But sometimes the product design calls for such a procedure and there's just no other way out. Williams, White & Company ran into just such a problem in making hot plates and bases for plywood-forming presses. The technique they evolved is discussed on page 212.

COMING

Proper lighting is rapidly becoming recognized as an efficient production tool. Ideas of proper lighting have undergone a radical change, however, with the result that industrial illumination can now be engineered even better than ever. In an early number we'll reveal what this new lighting concept is and how it can best be put into practice.

Calculating change gears for cutting spur gears is no problem at all, but when it comes to helical gears that's something else again. The key to the situation lies in converting a terrific decimal into a corresponding fraction. A new streamlined method of doing it makes the whole job easier. You'll find it in a forthcoming number of AMERICAN MACHINIST.

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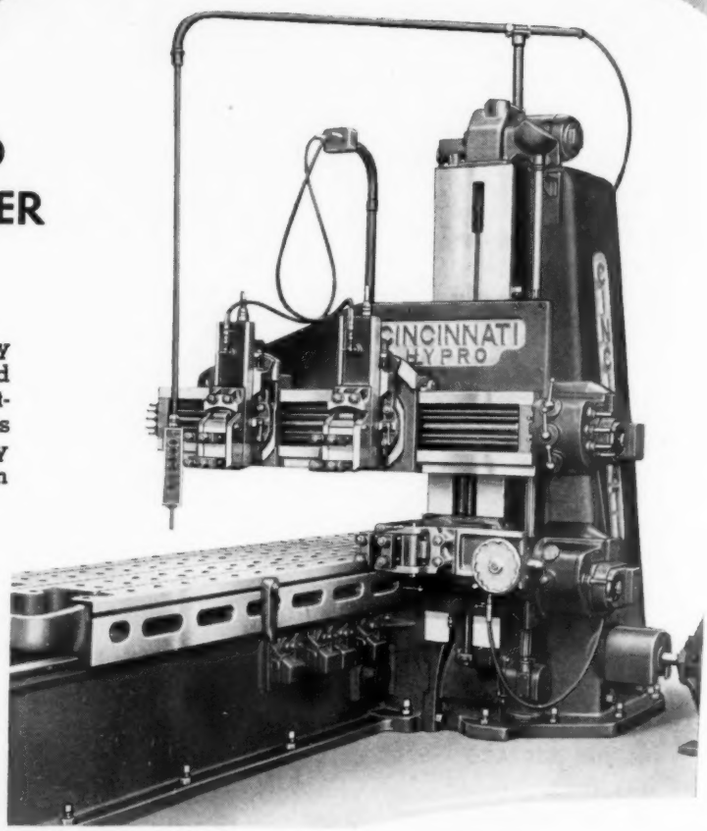

For detailed information on every operation of this Cincinnati Hypro Planer, write for new Bulletin No. 110.

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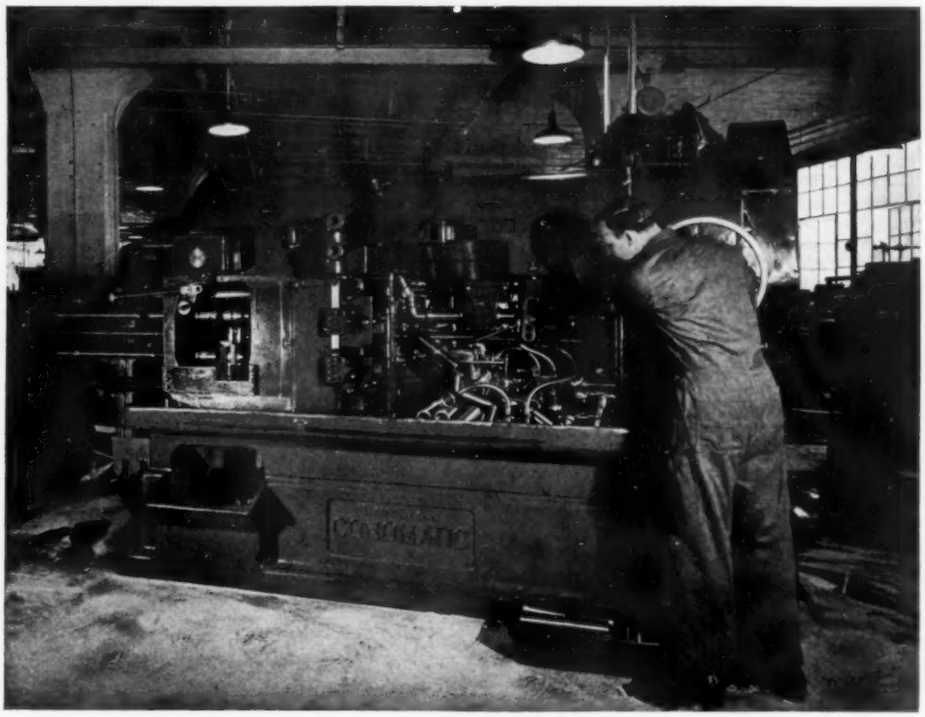
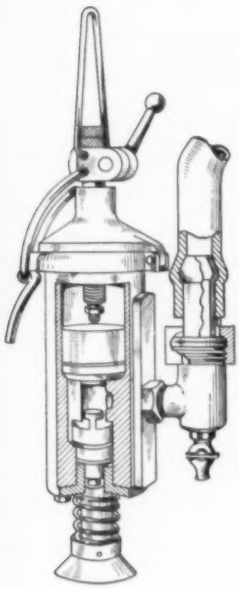




A four-spindle Conomatic set up for machining bodies of the illustrated acromatic syruper, six of which are used on the Cem 40 rotary bottling unit. The body and internal parts, all of stainless steel, are made on a production basis in automatics. The bright finish on the machined bodies is typical of all the machine work

What it takes to turn stainless

A large tonnage user gives the results of 15 years experience in cutting stainless steels on automatics and turret lathes

WHAT ARE THE best practices in machining stainless steel on turret lathes and automatics? The Crown Cork & Seal Company, maker of automatic bottle crowning and combination filling-crowning machines has the answer. Its standards, developed through years of experience, are used today in machining between 200 and 300 tons of stainless annually for thousands of parts held to close tolerances and having smooth machined surfaces.

Stainless steel was adopted fifteen years ago by this company for parts of bottle-filling machines subject to corrosion from liquids handled. In addition, it was thought that the exterior portions of these parts could be finished smooth and made to harmonize in appearance with adjacent sheet stainless and nickel-silver surfaces. But it was one thing to adopt stainless for its corrosion-resistant properties and surface appearance, and quite another to machine it with a smooth surface at high production rates and low cost. Consequently, its early use was limited to internal working parts of the machines from which long and uninterrupted service was demanded. For the most part, these were made on turret lathes.

In early attempts to machine stainless, chip removal exerted such pressure on the nose of the tool that a built-up edge resulted. The tool would run hot, the job would have to be slowed down, and it was next to impossible to obtain a finish satisfactory for the snug fits demanded for the internal parts of the bottle fillers. Although the advent of "free-machining" stainless solved some of the cutting problems, other grades which are used extensively by Crown remained difficult to machine.

From the beginning of its experience in machining stainless, Crown kept accurate records of all the machining problems. Standard practices were evolved slowly. These have proved so successful that today thousands of intricate machine parts are turned out daily with a "polished" finish on a battery of twelve automatics and nine turret lathes working two shifts on the present production schedule. Machine set-ups, as well as cutting speeds and feeds, are supervised carefully to conform to standard practices. All cutting tools are maintained to accurate standards by toolmakers.

Certain simple rules, followed care-

SPEEDS AND FEEDS FOR MACHINING STAINLESS STEEL

Type of Stainless	Turning: High-speed tools Speed	High-speed tools Feed	Tantalum-carbide Speed	Tantalum-carbide Feed	Drilling speed*	Reaming speed§	Tapping speed	Threading speed
416	130	0.006	300	0.006	130	30–60	30	35–40
430F	140	0.006	320	0.006	140	30–60	30	35–40
420	80	0.004	200	0.004	80	20–50	15–20	20–25
302	100	0.015*	220	0.015*	100	20–50	20	25–30
303	105	0.015*	230	0.005*	105	20–50	20	25–30

* These are feeds used on turret lathes.

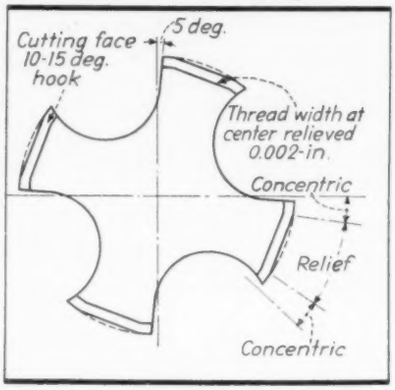
‡ Drilling feeds range for 0.005 to 0.010 in. Both drilling speeds and feeds are often adjusted downward to avoid excess peripheral speeds at the outside of the piece when turning and drilling simultaneously; however, tantalum-carbide tools are used to take advantage of such high turning speeds.

§ Reaming feeds vary from 0.004 to 0.012 in. Both speeds and feeds may be adjusted downward for the same reasons as when drilling.

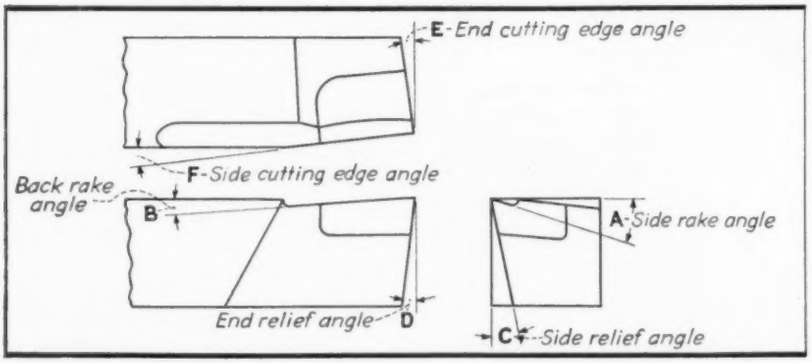
fully, have considerable bearing on the quality of finish obtained and on length of tool life: All cutting tools, drills, reamers, taps and thread chasers must themselves have a bright surface finish to prevent chips from clinging to the cutting edges and scoring the machined surface of the parts. All cutting tools except form tools must be ground with a chip breaker to remove chips quickly from the machined surface. All tools must be ground with fine grit wheels. All machining must be done under a flood of coolant.

Other machining practices depend upon the type of stainless. The Crown Cork & Seal Company uses types 416, 430F, 420, 302 and 303. Round stock up to 3½ in. diameter is used with a specified hardness of 210-230 Brinell. After experimenting with various cutting tools, only those of high-speed steel and tantalum-carbide are now used.

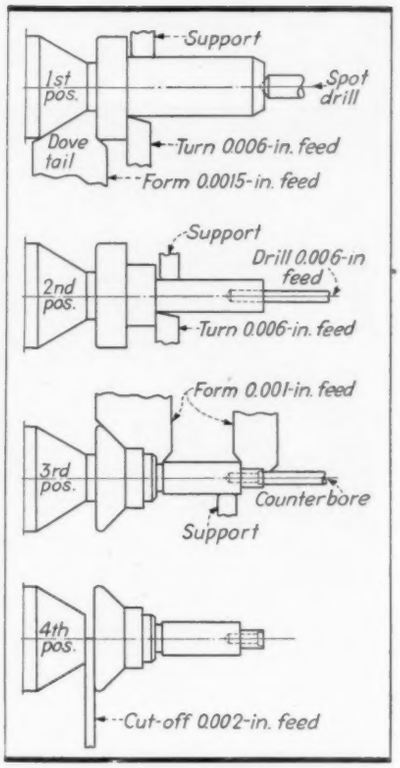
In machining stainless steel on automatics, turning is frequently done simultaneously with drilling and reaming operations. Speeds for satisfactory drilling and reaming often result in high peripheral speeds at the outside of the stock. When such conditions occur, tantalum-carbide tools are used to take advantage of the high speeds; otherwise, tools of high-speed steel are used. The optimum turning speeds and feeds for high-speed and tantalum-carbide tools are given in the table.



Threads in tapped bottling machine parts must be full and true. Crown uses this center-relieved tap for 416, 420, 302 and 303 stainless steels. Taps with 10 deg. negative rake on the cutting face and heel are used for type 430F



Single-point cutting tools for machining stainless have steep side-rake angles formed by a ground groove which serves as a chip breaker. For high-speed steel tools A=12 deg., B=4 deg., C=6 deg. for heavy cuts and 7 deg. for light cuts, D=3 deg., E=10 deg., and F=10 deg. For tantalum-carbide tipped tools A=6 deg., B=4 deg., C=8 deg., D=6 or 7 deg., E=10 deg., and F=10 degrees

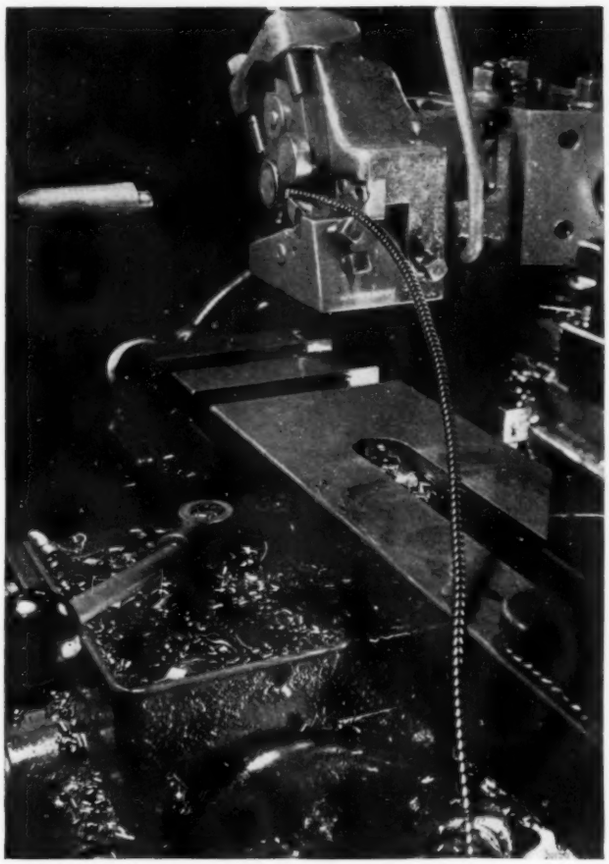


This is a typical set-up for machining stainless steel parts on a 3½-in. four-spindle Conomatic. Spindle speed—154 r.p.m.; surface cutting speed—91 ft. per min.; machining time—235 sec.; idle time—5 sec.; production time—240 sec.; production—12 pieces per hour based on 80 per cent production time

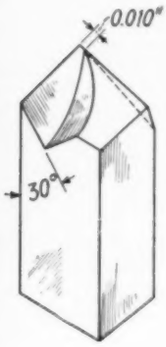
The side rake of high-speed turning tools is 12 deg. This steep angle is formed by a groove in the top of the tool which conveniently forms a chip breaker although it was originally ground in the tool to prevent cutting the 12 deg. angle all the way across the tool. Such a groove makes it possible to regrind the tools many times, moving the groove back with each resharpening.

The 12 deg. side rake angle is also used with tantalum-carbide tools for machining 430F stainless. For 416, 420, 302, and 303 types, a 6 deg. angle is used. This 6 deg. angle is formed by grinding a groove in the tool, thus retaining the chip-breaker characteristics.

The side relief angle for high-speed steels is 6 deg. for heavy cuts up to ⅜ in. and feeds of 0.006 in. per revolution. On lighter cuts, the side relief angle is increased to 7 deg., using feeds of 0.009-0.010 in. per revolution. On tantalum-carbide tools, this angle is 8 deg.



A box tool with a ground chip breaker forms a continuous helical chip, prevents scoring of the work, and produces a smooth finish. Although shown here in a Warner & Swasey turret lathe, box tools are used extensively on automatics for machining parts of Crown filling-crowning units



The back rake angles on all tools is 4 deg. An end relief angle of 3 deg. is used on high-speed tools, this being increased to 6 or 7 deg. on those tipped with tantalum carbide.

Box tools are used extensively in machining stainless parts for the bottling machines. The rollers are set about 0.010 in. behind the cutting edge of the tool. A small degree of burnishing is obtained by using relatively high roller pressures. The box tools, ground with a groove as shown in one of the drawings have a 0.010 in. land at the cutting point, but contrary to usual practice, there is no land on the edge which forms the side relief angle. This aids in eliminating a built-up tool edge which inevitably results in a poor finish and reduction of tool life. The front of the tool is beveled for clearance. The chip groove formed by machine grinding, curls the chips in continuous helical form for convenient removal at high cutting speeds.

Tapping stainless was one of Crown's most difficult problems. But today true and full holes are obtained using high-speed taps. The soft core of stainless stock invariably caused standard taps to tear the threads when withdrawing from the holes. Taps with 10 to 15 deg. hook grinds did not solve the problem; although those with both an even and uneven number of flutes and interrupted threads resulted in some improvement, they were not completely satisfactory. Standard taps were then ground with a 10 deg. negative rake on the cutting face and heel, which proved to be better than other grinds, especially for 430F stainless. This thread shape was retained for 430F type, but center-relieved taps were finally adopted for other types.

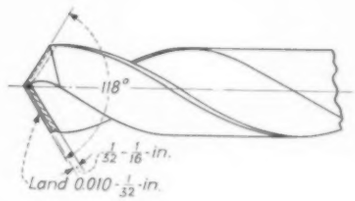
The threads of the center-relieved taps near the cutting face and heel are concentric with the tap body, but the center portion is relieved by decreasing the tooth height and thickness as shown in one of the drawings. The cutting face has a 10 to 15 deg. hook, while the heel has a 5 deg. negative rake. Tapping speeds are given in one of the tables.

Collapsible threading dies are used for external threading whenever possible, especially for 430F stainless. Tangent-type chasers only are used. The cutting edges of the dies are kept smooth, and for 430F steel, the threads are ground with a 10 deg. lip hook; this angle is increased to 15-20 deg. when threading all other grades of stainless used by Crown. External threads are cut at the speeds given in the table.

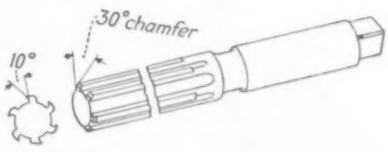
When Crown first attempted to drill stainless steel, it was found that the standard drills did not perform satisfactorily until two grooves were cut parallel to and near the cutting edges. Lands of 0.010 and $\frac{1}{32}$ in. respectively are used on small and large drills, with grooves on the former being $\frac{1}{32}$ in. wide and $\frac{1}{16}$ in. on the latter. The grooves prevent built-up cutting edges on the drills and force the chips to curl continuously from the tip. With chips thus removed, scoring of the hole surface is prevented. Oil drills, also with chip-curler grooves, are used for deep drilling.

The point angle is 118 deg. for most drilling, although this is increased to 150 deg. when drilling large holes, especially in "hard-

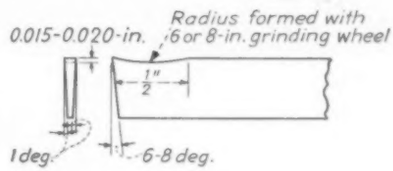
Drills for stainless steel perform best when $\frac{1}{32}$–$\frac{1}{16}$ in. grooves are cut parallel to and near the cutting edges, using 0.010–$\frac{1}{32}$ in. lands. The grooves force the chips to curl from the point, avoiding build-up edges and scored surfaces



Reamers ground with a 10 deg. lip hook and chamfered 30 deg. on the end of the flutes give the longest service and produce the smoothest surfaces when finishing holes in stainless steel



Cutting-off tools have back rake formed by a 6 or 8-in. grinding wheel. Cutting speeds are the same as for turning with high-speed steel tools—80 to 140 surface feet per minute



machining" stainless steels. Experience has shown that 12 deg. is the best lip relief angle for large drills, although on small drills this can be decreased to 8 deg. for a short distance near the cutting edge with a secondary relief of 12 deg.

Drilling speeds and feeds are given in one of the tables. When drilling and turning simultaneously, especially on large diameter stock, these speeds are reduced to prevent using cutting speeds for tantalum-carbide higher than those given in the table. However, with speeds for tantalum-carbide tools running as high as 300 surface ft. per min. it is not often that the drilling speeds have to be reduced excessively.

The reaming of working parts for Crown bottling machines must of necessity be precise, not only to produce smooth holes but in many cases ones which are concentric with outside diameters. In the latter case, the holes are first bored, leaving 0.003-0.005 in. of metal to be removed by the reamer. When such concentricity is not important, the holes are drilled, leaving $\frac{1}{64}$ in. for reaming.

All reamers are of high-speed steel, and have a 30-deg. chamfer at the ends of the flutes, rather than the usual 45 deg. This has been found to insure smoother holes and increase reamer life. The flutes are ground with a 10 deg. lip hook.

Large holes in 416 and 430F stainless are reamed at 60 surface ft. per min., and 0.004 in. feed per revolution. For 420, 302 and 303 types, the surface speed is decreased to 50 ft. per min., using the same feed. For small holes, 416 and 430F steels are reamed at 30 surface ft. per min., at 0.012 in. feed per revolution; using the same feed, 420, 302 and 303 stainless are reamed at 20 surface ft. per min.

The contours of many bottling machine parts are made with form cutters in both turret lathes and automatics. A bright machine finish is invariably demanded, because these surfaces are frequently exterior portions of the machine and must be as highly polished as possible to compare in appearance with adjacent sheet stainless and nickel silver parts. A simple expedient produces the required polished surface: rough forming is first done with a high-speed tool on the front cross-slide, leaving a few thousandths for finishing by a tantalum-carbide tipped form cutter mounted on the back cross-slide.

Stainless steel of the 302 and 303 types is rough formed at surface speeds of 100-110 ft. per min.; 416 and 430F at 130-140 ft. per min.; and 420 stainless at 80 ft. per min. Finishing speeds are 100 per cent faster. Roughing and finishing feeds of 0.002 and 0.001 in., respectively, produce the desired finish.

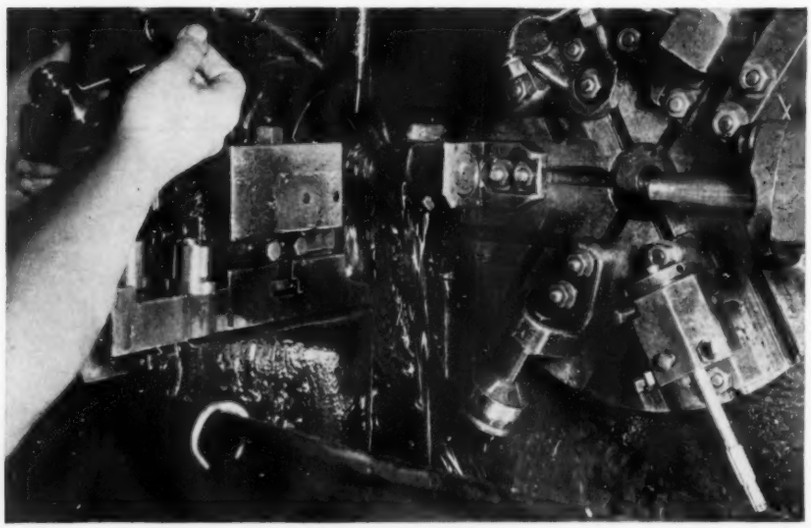
Because stainless steels are difficult to machine and obtain a smooth finish, a flood of coolant should be used at the cutting tool. Whatever lubricating qualities the coolant may have aids in passing the chips across the nose of the tool. An excess of coolant flushes chips from machined surfaces and prevents scoring.

Sulphur base coolants are the only ones recommended for machining stainless steels. Recommendations have varied considerably from viscous mineral lard oils containing 8 per cent sulphur and cut to a 1:1 ratio with paraffin base oil, straight sulphur base oils, and in rare instances soluble oils. From an economic standpoint, based on cost of cutting oils and length of tool life, the Crown Cork & Seal Company uses a mineral lard oil containing $3\frac{1}{2}$ per cent sulphur. Six parts of this oil are mixed with one part of paraffin oil. Saybolt viscosity runs 100 sec. at 120 F.

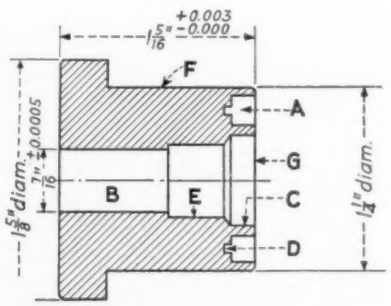
CHEMICAL COMPOSITION OF STAINLESS STEELS §

Type of stainless	C	Cr	Ni	S	Mn	Si
416	0.12*	12 –14	0.50*	0.15–0.40*	0.25–0.60	0.50*
430F	0.12*	14 –18	0.50*	0.15†	0.25–0.60	0.50*
420	0.40*	12 –14	0.50*	0.15†	0.25–0.60	0.50*
302	0.20*	17½–19	8–9½	0.03*	0.25–0.60	0.75*
303	0.20*	17½–19	8–9	0.03*	1.25*	0.75*

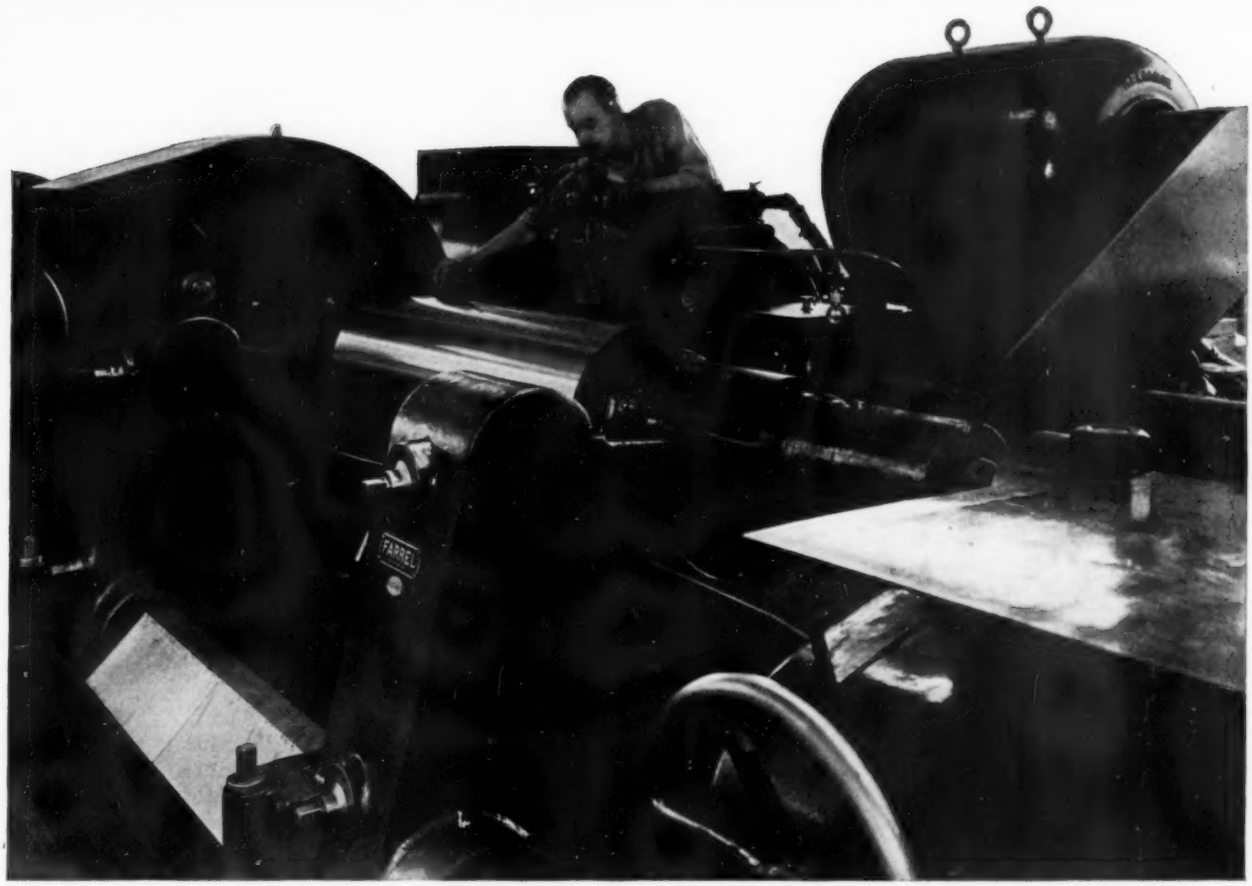
* Maximum. † Minimum. § These are the only types used by the Crown Cork & Seal Company.
Type 303 also contains 0.16 P max and 0.07 Se min.



A typical set-up on a B.&S. automatic is shown here machining an adapter for a beverage bottling machine. The bright smooth surface on the machined part is obtained by taking a finishing cut of 0.001-in. feed with a tantalum-carbide tipped form cutter during a counterboring operation. The sequence of machining operations are listed at the right



1. Index the turret.
2. Drill *B* at 0.005-in. feed and when nearly completed rough groove *A* at 0.0015-in. feed. Drilling is started at 130 surface ft. per min., but when grooving is begun drilling is slowed to 90 surface ft. per min.
3. Start counterboring *C* and *E* at 0.002-in. feed and 130 surface ft. per min., but slow down to 90 surface ft. per min. for finish grooving *A* and *D*. While grooving *A* and *D*, start forming *F* at 0.001-in. feed and 130 surface ft. per min. 4. Ream hole *B* and face *G* at 0.002-in. feed and 50 surface ft. per min. 5. Cut-off at 0.003-in. feed and 130 surface ft. per min.



Grinding is one of the best ways of producing both a high-quality surface and an excellent finish

What is surface quality?

BY H. J. WILLS, ENGINEER, THE CARBORUNDUM COMPANY

It's more than just a high polish. It involves many complex factors. But it can be indicated by just a single number

A PERFECT SURFACE isn't hard to imagine. It would have exactly the right contour—no waves, warps or other deviations from the desired shape. It would be free of both ridges and valleys — absolutely smooth, right down to the last molecule. And it would naturally be devoid of blemishes.

No one has ever produced a surface like that, and probably no one ever will. But the degree to which it is approached is gaining in importance every day, and is rapidly becoming harder to describe or specify accurately.

Lack of generally used standards for surface quality has caused much confusion over what a given description of a surface really means. One shop may use interchangeably the terms polished, reflective, mirror and ultra, while another may apply them to distinctly different types of finishes. One shop may consider only commercial, fine and mirror surfaces, while still another may distinguish between rough, rough commercial, commercial, good commercial, reflecting, high, ultra and high luster. And what is considered a mirror surface by one man may be regarded as simply reflecting by another. Especially when the better-quality surfaces are considered, entirely too much reliance is placed on their appearance, which is often merely a matter of finish.

For a high-luster finish may disguise a very imperfect surface, while an almost perfect surface may present a dull, velvet or matte appearance. Within limits, nearly any class of finish may be applied to nearly any surface. But the finish will not correct surface blemishes. Burnishing with a dull grinding wheel, for instance, will produce a high finish on a surface composed of high hills and deep valleys, an effect caused by folding over the high ridges. But soon the bent-over metal will wear off and the original poor surface will be exposed.

Deviations from the perfect surface consist chiefly of isolated flaws, waviness and roughness. Typical flaws are checks, cracks, scratches, holes and the like, which are easily spotted. Waviness may be random or recurrent, the waves usually being only a few thousandths high and ranging from four hundredths of an inch to an inch apart. It can be

measured by suitable dial gages. Roughness—the defect usually meant by shop men when they discuss surface quality—is generally thought of as a hill-and-valley condition, although it is more accurately regarded as a series of waves superimposed on either a true surface or a wavy one.

Until recently there has been no way to determine accurately the amount of surface roughness. The most commonly used shop method is the "eye and fingernail" test. As we know, the unaided eye is not reliable in determining roughness, as it is too likely to be misled by polish which may disguise a rough surface. Rubbing the fingernail or fingertip across the surface is a more reliable guide, but is obviously not precise, as it can give no exact mathematical measurement of the roughness.

The same fault exists in most other methods commonly used. Merely to examine the surface with a microscope leaves too much to the human element. Microscopic examination of a profile section of a piece which has been copper-plated and cut through is quite accurate, but requires destruction of the test piece. There is also danger of deforming the surface when cutting the section.

A fairly consistent test is to draw a pencil lead across the surface under constant load and measure the speed at which the lead wears. This method, however, gives no indication of the actual shape of the hills and valleys, and is not mathematically indicative. Another method is to draw a phonograph pick-up across the surface and estimate the roughness by a loudspeaker or graph of the voltage generated.

A mathematical measurement of surface roughness may be secured by the Profilograph or the Profilometer. The Profilograph consists of a stylus to which a mirror is attached. As the stylus is drawn across the surface, a beam of light is reflected from the mirror onto a moving strip of sensitized paper, thus making a magnified graphical record of the surface. The Profilometer operates on the same principle, except that the magnification is produced electrically instead of optically. With it, direct readings can easily be made to micro-inches—a micro-inch being 0.000001 in. Another sensitive device of this type is the Brush surface analyzer. In it a jeweled stylus traverses the portion of the surface to be analyzed, moving either in a 0.05-in. circle or reciprocating along a 0.05-in. line.

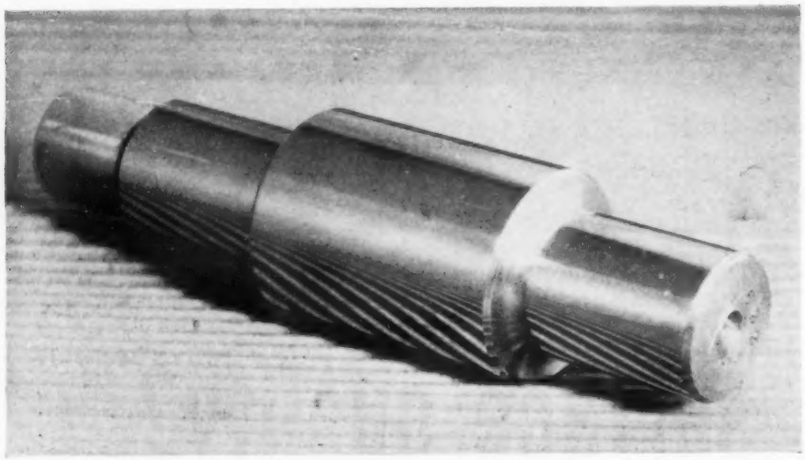
Such devices can help considerably in judging surface roughness by cruder methods—by touch, for instance. A sample surface duplicating the required surface is prepared and checked with the Profilometer or similar device. Comparing the work pieces with this standard by any of the usual methods enables quite small differences to be detected.

A great deal of study has been given to the mathematical description of surface roughness by the Committee for the Standardization of Classification and Designation of Surface Qualities under the sponsorship of the A.S.M.E. and the S.A.E. It has proposed as a measurement of surface roughness the root-mean-square average. A way to determine the r.m.s. average is to draw the axis through the graphical representation of the surface as determined by the Profilometer or similar instrument. The axis is divided into a large number of equal intervals. At the points of division the distances above or below the axis are measured, squared, added together, divided by the number of intervals, and the square root taken. As the measurements are all made in micro-inches, the resulting r.m.s. average is in micro-inches. (Most electric surface-roughness measuring instruments are equipped with a meter which indicates average r.m.s. roughness values directly in micro-inches.) This is the measurement of surface roughness, and is indicated by a number—63 being the surface roughness of a piece showing an r.m.s. average of 0.000063 in., for example.

The committee makes no recommendations as to r.m.s values for any surfaces. However, tests show that values for certain types of surfaces run about as indicated in the table. The work of the committee was to determine a mathematical measurement of surface roughness and a means of expressing it. Now that this has been accomplished there is no need for anyone to be misled by a fine polish hiding a poor surface.

Furthermore, it is no longer necessary to use loose terms such as good commercial, commercial, ultra and the like in specifying a finish. The drafting room can designate a surface merely by a number, with the knowledge that it will mean to every man in any shop just one thing.

Any present method of specifying surface quality can readily be translated into micro-inch r.m.s. averages. When universal, this system will possess obvious advantages. A buyer can specify exactly the surface he wants. At present what may mean commercial finish to him may mean something much smoother or rougher to the manufacturer. Furthermore, the designer, machine operator and inspector will all speak the same language.



This jeweler's roll was ground to a surface smoothness of 0.8 micro-inch. Only an extremely high polish would improve it

TYPICAL R.M.S. SURFACE ROUGHNESS VALUES

Surface	*Roughness, micro-inches*
Highly polished.....	$\frac{1}{4}$–$\frac{1}{2}$
Ground, honed and lapped	1–4
Turned with diamond or hard metal, finish ground, honed, or molded (smooth)..	8–32
Turned, bored, or milled	63–1,000
Rough machined, tool marks clearly visible	4,000–63,000

Car ends oil heated

BY W. J. TANGERMAN, GENERAL PLANT SUPERINTENDENT, UNION METAL PRODUCTS COMPANY

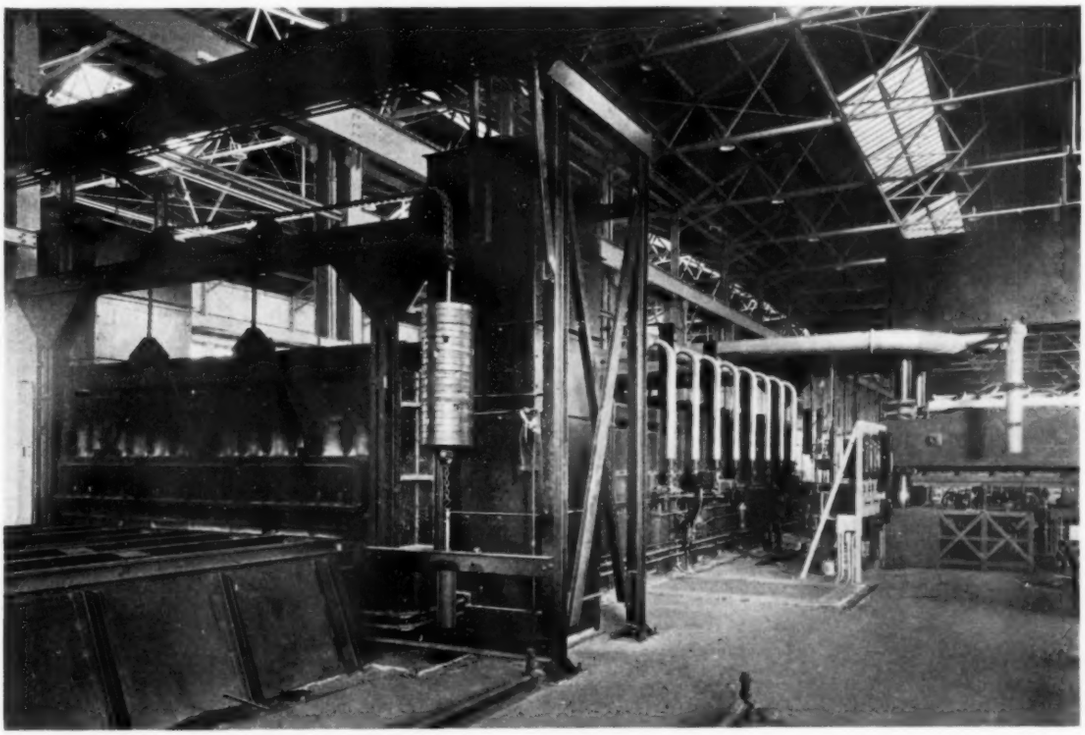
Prior to pressing, end plates are brought up to heat in a continuous furnace. Automatic control prevents scaling

SUCCESSFUL PRESSING of corrugated freight-car ends requires heating large steel plates in a continuous furnace to uniform temperature. Our answer to the problems involved in such heating is the illustrated three-zone oil furnace. It is 12½ ft. wide by 43 ft. long inside and heats 17 to 24 tons of plates per hour at a fuel-oil consumption of 8 gal. per ton of plates. It takes but 3½ min. to heat any given plate to an exact final temperature in five steps.

Cold plates are placed one at a time on the I-beams at the charging end of the furnace. A pneumatic plate-handling carriage beneath the furnace supports six 3-in. water-cooled alloy pipes which lift periodically by cam action, carry the plates forward to the furnace step and then sink beneath the furnace floor to return to their starting position for the next stroke. Just inside the furnace, the plates enter a preheating zone where there are no burners. Waste gases from sixteen burners, located in the final two-thirds of the furnace, pass to the charging end and out through two stacks. In the center third, or heating zone, are eight Hauck oil burners, four on a side, set for 1,400 F. In the final third, or hot zone, are eight more Hauck burners set for 1,650 F. when heating open-hearth plates, or for 1,800 F. when heating alloy plates. Red-hot plates pass directly from the far end of the furnace to a 2,000-ton hydraulic press.

The burners, pre-adjusted for correct combination of oil and air blast, are controlled in groups of four by servo-motors, which in turn are controlled by Leeds & Northrup thermostatic regulators. Oil pressure is 30 lb., and Spencer blowers provide air blast at 1 lb. per sq. in. Control instruments are mounted on a panel adjacent to the press-operator's stand.

The furnace accommodates plates $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, and $\frac{3}{8}$ in. thick, 24 to 84 in. wide and 108 to 135 in. long. Materials may be open-hearth or alloy steel, depending on specifications. No trouble is experienced in heating either. However, when alloys were first heated, particularly those of the Manten type, we experienced trouble with scaling of plates in the furnace from the blast of air at the hot end every time the doors were opened. This was corrected by installing a burner set for excessive oil consumption and controlled by the door. Now when the door is opened, this burner emits a cloud of partially burned gas which mixes with the incoming air to make a combustible mixture and prevents scaling.



It takes but 3½ min. to heat plates as large as ⅜x84x135 in. to accurately controlled temperatures in this continuous furnace. Automatic operation through loading, heating and unloading zones speeds production in manufacture of open-hearth and alloy corrugated freight-car ends

Varied set-ups with standard tools

BY J. R. LONGSTREET AND W. K. BAILEY, THE WARNER & SWASEY COMPANY

On many seemingly difficult jobs a special set-up may not be necessary. Often it can be avoided by a knowledge of standard equipment available

BAR MACHINES and chucking machines are basically the same, but there are some important differences between bar tools and chucking tools. Because of the very nature of bar work, most bar tools may be built to support the work while the cutter is removing metal. The cutting forces are usually self-contained within the tool, Fig. 25. In the case of chucking tools, Fig. 26, there is an overhang which does not exist in bar tools.

Cutters should always have the largest cross-sections the work and holder will allow to get out of the machine all that is built into it. Larger cutters increase the rigidity of the set-up so that speeds and feeds can be increased. If necessary, a large cutter may be overhung to get a better combination of cuts. Small cutters should be used only for light finishing cuts.

Bar turners (sometimes called box turners or roller turners) are held on the turret and combine in one unit a cutter holder and a steadyrest that travels with the cutter and supports the work. The setting and grinding of bar turner cutters is the same in principle as the setting and grinding of cross slide and multiple turning head cutters. However, bar turner cutters are usually held in a semi-vertical position so the cutting angles are ground on the top end rather than on the side.

The steadyrest on most bar turners is built with rollers to eliminate wear and to make it possible to run the work at high speeds. A single-cutter bar turner is shown in Fig. 25, while Fig. 27 shows a universal bar turner. Some bar turners are built with V back rests. These are double ended. The roller rest can be operated at high speed under heavy cuts, and is used when cutting steel or other continuous-chip metals. V back rest tools are used when turning brass and other free-cutting materials where there is no problem of wear and where small chips are produced that might get under rollers and mark the work.

With bar turners designed to hold only one cutter at a time, such as those shown in Figs. 25 and 27, the cutter is held in a vertical position and is tilted slightly toward the cut and toward the work. Pressure of the cut is downward through the shank of the cutter. Multiple cutter bar turners, Fig. 28, are designed to hold cutters in a horizontal position.

Rollers in bar turners may be set either ahead or behind the cutter. If the rollers follow the cutter, there is the advantage that they burnish the work. The pressure of the cut forces the work against the rolls with the result that tool marks are rolled or burnished to a smooth finish. This may eliminate the need for polishing or grinding operations.

When a diameter must be turned accurately concentric with a previously finished diameter, the rolls are run ahead of the cutter on the previously finished surface. On the universal turner, Fig. 27, rolls are set ahead or behind the cutter by adjusting the cutter. On the turner shown in Fig. 25 the cutter is fixed and the rolls can be moved.

The setting of both types of roller bar turners is essentially the same. Steps in setting up the single cutter turner, Fig. 25, are as follows: First, extend the bar stock from the collet about $1\frac{1}{2}$ to 2 in. With a cutter in the cross slide turn the bar to 0.001 in. under the desired size for a length of $\frac{1}{2}$ to 1 in.

With the rolls in the turner swung out of position and with the cutter set above center, adjust the cutter slide to bring the tool against the turned portion of the bar and rub a light "shine" mark on the turned portion.

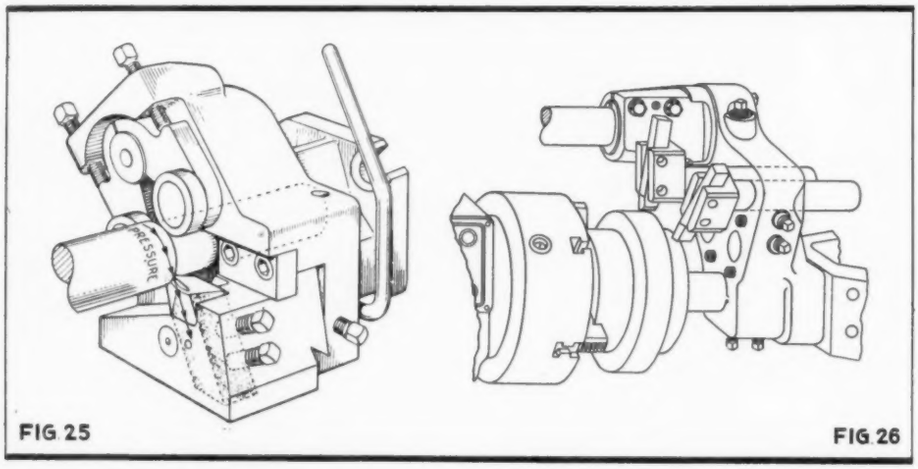


Fig. 25—Because of the nature of bar work, bar tools usually can be made to support the work during the cut. Fig. 26—In a chucking set-up the tools overhang the work and must be designed for the greatest rigidity

Then set the point or cutting edge of the tool at the center of the mark, clamp the cutter tightly in its slide, turn the spindle enough to move the shine mark away from the point of the cutter, and adjust the slide until the cutter is 0.0005 in. from the turned diameter. The cutter now is set and the rolls can be positioned endwise and adjusted to size. The rolls are properly adjusted when a light pressure of the thumb will stop them from turning as the bar is revolved. Be sure that the roll jaws are clamped solidly in this position. Size adjustments are made at the cutter slide.

The relation of the cutter to the roll face is important because it will determine the quality of the finish. In general, the back of the point radius on the cutter should not be ahead of the rolls by more than $\frac{1}{32}$ in. for turned diameters up to 1 in., see Fig. 29. This may be increased slightly with heavy feeds and deep cuts, but it should not be more than $\frac{3}{32}$ in. even on diameters up to $4\frac{1}{2}$ in.

In connection with the use of bar turners, there are some points worth remembering:

1. Always use the withdrawal lever before the return stroke of the turret. It prevents marking the work as you bring back the turret.

2. With rolls following the cutter, it is usually true that the heavier the cut, the better the finish. The heavier the cut, the greater the pressure against the rolls and the greater the burnishing action.

3. With light cuts which do not force the work against the rolls with great pressure, special rolls with a steeper taper sometimes will produce a better finish. Standard rolls for bar turners are made with a slight taper—the larger diameter being at the front.

4. To get a better finish with light cuts the cutter must be ground so that the work is forced against the rolls with more pressure, or it must be ground to give a smoother cut so that the rolls will have less work to do.

Regardless of how deep a cut is being taken, there are three factors to watch in order to obtain a high grade finish: (1) faces of the two rolls must be in line, (2) leading corners or radii of the rolls must be perfectly round and exactly equal, and (3) end play in the rolls should not be more than 0.002 or 0.003 in.

Drilling and Boring

To produce accurate holes it is necessary to (1) hog out the bulk of the material in the hole, (2) true up the hole, and (3) take a sizing cut, as in Fig. 30. Usually the hogging is done with a drill, the trueing of the hole with a boring tool and the final sizing with a reamer. Sometimes, an especially accurate work, the hole is bored twice before reaming.

The accuracy of a drilled hole is determined by its start in the work. Since the drill usually is long in proportion to its diameter, it is easy to create a weave of the tool when the drill is starting in the work, especially if the end of the work is rough. To overcome this, starting drills are used. These always are short and rigid to stand up under heavy feeding pressure. In the case of large diameter holes produced on small, light machines, it is good practice not only to use a starting drill, but also to drill a small diameter hole the full length of the piece.

Boring cutters are used to (1) true up or enlarge drilled holes, (2) machine rough cored or pierced holes, and (3) finish holes to accurate size without reaming. Drilled holes should be bored when possible before reaming to overcome the eccentricity of rough drilled holes.

There are two general types of boring cutters—tool bits held in boring bars and solid forged boring cutters. Tool bits held in boring bars are used most commonly because this combination is inexpensive and provides much flexibility as to sizes and types of work produced. Solid forged cutters are used to bore small diameter holes that are two small to be bored with an inserted cutter. Forged cutters can be reground only a limited number of times and when the cutting edge is gone they must be reforged to renew the cutting point.

As the name implies, stub boring bars, Fig. 31 are short. They are made to hold the cutter at right angles to the work or at an angle, as shown, so as to extend beyond the end of the bar. The angular bar has the added advantage of an adjusting screw behind the cutter. When using a stub bar or forged boring cutter, the overhang should be as short as the hole and the set-up will allow. Sleeves can be used to increase the rigidity of small bars. Boring bars supported in

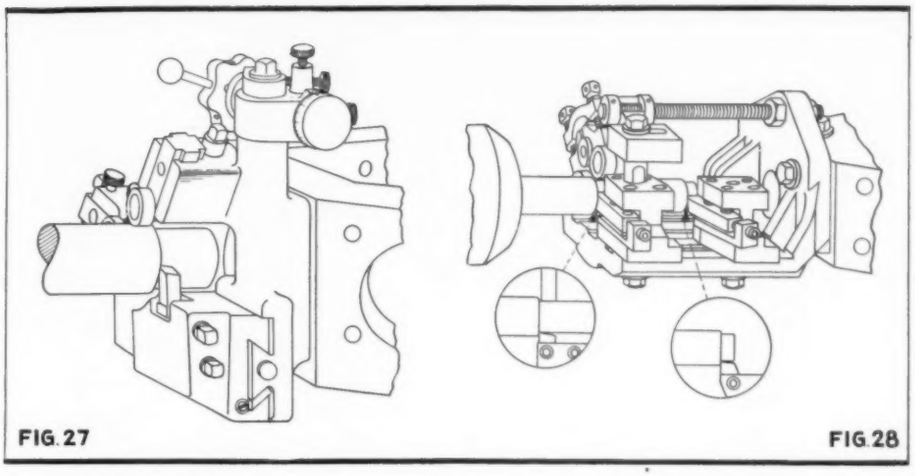


FIG. 27 FIG. 28

Fig. 27—Rolls on the universal bar turner are independently mounted on slides. Fig. 28—Multiple cutter bar turners usually are arranged to hold cutters horizontally

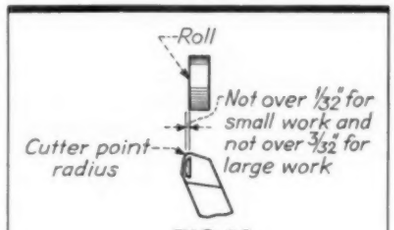


FIG. 29

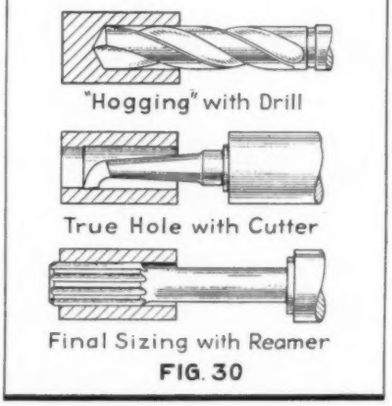


FIG. 30

Fig. 29—Face of roll should be close behind the point of radius of the cutter, never ahead of it unless set for the larger diameter. Fig. 30—Three steps usually are necessary to produce accurate holes

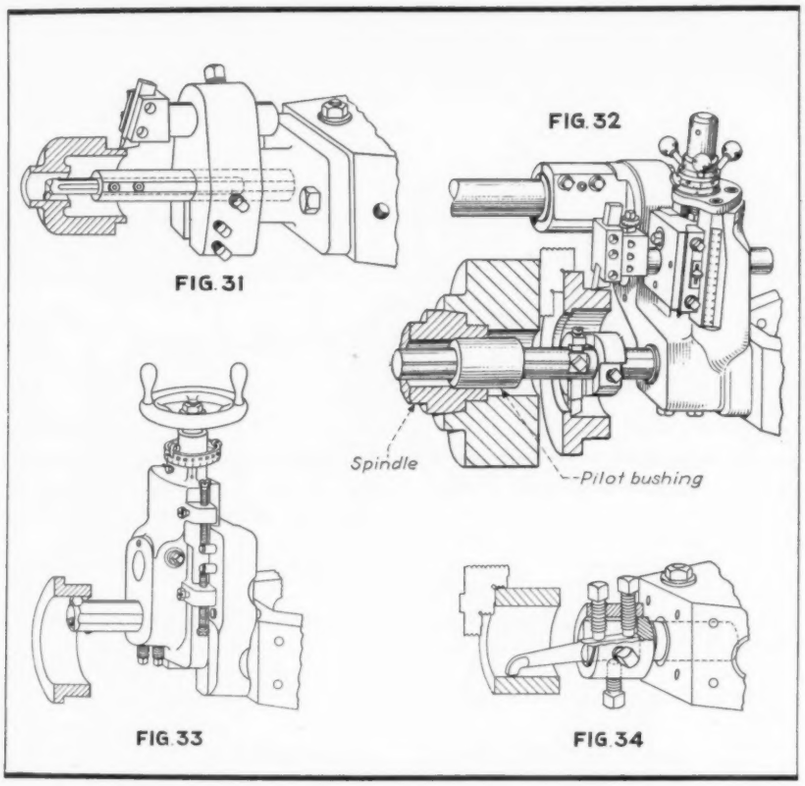


Fig. 31—Sleeves are used to increase the rigidity of small-diameter stub boring bars. Fig. 32—A heavier cut can be taken when boring bar is supported at both ends. Fig. 33—The slide tool is an important accessory for small and medium lot production. Fig. 34—Used for holding forged boring cutters, this adjustable holder can be used in turning heads

a pilot bushing, as in Fig. 32, permit heavy cuts with maintained accuracy.

On a turret lathe, boring cuts ordinarily are taken from the hexagon turret although, if necessary, boring tools can be held on the cross slide. There are a number of advantages in boring from the turret. Among them are (1) while the boring cut is being taken turning or facing cuts can be made with the cross slide at the same time, (2) boring cuts can be combined with turning cutters held in multiple or single turning heads, and (3) a boring cutter on the turret is held in a fixed position and need not be adjusted each time a cut is taken.

Boring bars held in slide tools, Fig. 33, can be adjusted to size. The slide tool makes it possible to use the same cutter or bar for a number of different diameters on the same piece when used for small lot production. In addition to boring cuts, the slide tool can be used for recessing, grooving and backfacing. The adjustable boring cutter holder, Fig. 34, is less expensive than the slide tool and can be used over a small range of sizes. This holder has the advantage that it can be used in a single or multiple turning head.

A good motto is, "Form it if possible." Forming is one of the fastest methods of producing a finished diameter or shape, and when planning a set-up the work should be studied to see if form tools can be used.

It often is possible to combine two or more cuts into one by using a special forming cutter. Besides combining two or more cuts into one, forming cutters also are used for producing irregular and curved shapes difficult to turn in any other way.

Three Forming Cutters Used

There are three types of forming cutters: (1) forged cutters, (2) dovetail or straight forming cutters, and (3) circular forming cutters. Forged cutters ordinarily are mounted directly in the square turret or tool post and are the least expensive of all forming cutters to make. On the other hand, they have the shortest life.

A typical dovetail or straight type forming cutter is shown in Fig. 35. Dovetail forming cutters are held in standard holders which are mounted on the cross slide. These cutters have their shape or contour machined and ground the full length of their face, and they are set in the holder at an angle to provide front clearance. In order to adjust for any slight inaccuracies in the cutter or holder, the holders have a swivel or rocker adjustment in the base. Dovetail forming cutters cost more than forged forming cutters but they last longer, are set up more easily, maintain their form after sharpening, and can be operated under heavier feeds.

A typical circular forming cutter job is shown in Fig. 36. These cutters have a life even longer than that of the dovetail or straight forming cutters. The shape is ground on its entire circumference, as the top surface is reground for sharpening the cutter is moved up to position simply by rotating the cutter on its axis. Holders for these cutters can be used on the front or on the rear of the cross slide.

Just which type of forming cutter should be used depends, of course, on the job. The advantage of time saved by use of a form cutter must be weighed against the cost of the tool. The larger the lot to be produced, the more you can afford to spend for special tooling of this type.

Thread Chasing Equipment

Until recent years, small- and medium-lot work normally was done on a turret lathe, then moved to an engine lathe if threading was required. Today, however, the necessary thread chasing equipment is available for universal turret lathes. Combining turning and thread chasing operations assures proper relation between turned and threaded diameters and saves time previously required for chucking the work a second time.

Dies and taps provide a means of cutting threads easily and quickly, and usually in only one pass over the work. For most production jobs, even in small lots, if you have the necessary tools threading with dies and taps is by far the best and least expensive method. However, these tools have certain limitations. Their cost goes up rapidly with their size, and they are difficult to use for cutting long threads that must have an accurate lead.

Threads are cut with single-point tools when the work is of large diameter or when the work must be extremely accurate. Single-point tools also are used: (1) on odd lot jobs when necessary dies or taps are not available, (2) on jobs which require a special type of thread for which standard taps and dies are not available, (3) on jobs where dies cannot be used because of the shape of the work, and (4) on jobs with extra long threads when the work will not

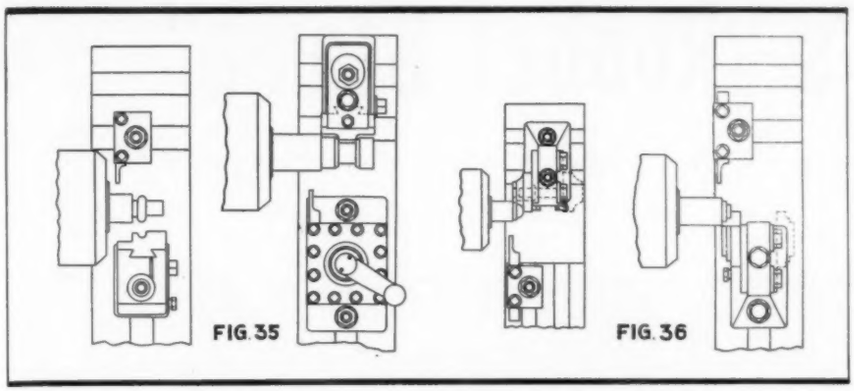


Fig. 35—Typical forming jobs employing straight cutters and holders
Fig. 36—Circular forming cutters have longer life than dovetail cutters

pass through the threading die head.

In order to cut extremely accurate threads, dies and taps sometimes are led on by means of various types of attachments. In this way the time saving advantages of taps and dies are combined with the precision advantages of single-point attachments. These attachments usually incorporate a leader-and-follower arrangement or an independent leadscrew.

On turret lathes there are two different methods of producing threads by means of a single-point cutter. One is to obtain an angular feed to the cutter by means of the compound carriage, as at *A* in Fig. 37, or by means of an adjustable threading tool holder such as that shown at *B*. The other method is to feed the cutter straight into the work for each pass at a *C* in Fig. 37. With the first method the cutting tool is fed into the work at an angle until the final polishing passes, then the cutter is fed straight into the work by moving the main slide. With the second method the operator supplies by hand a slight drag to the carriage or saddle during the roughing cuts and removes the drag during the final passes.

Taper Turning

There are three general methods of producing tapers on turret lathes: (1) with forming cutters, (2) with roller rest turners (for bar work), and (3) with taper attachments. The method to be used will depend upon the work itself, the accuracy required, the equipment available, and the quantity to be produced.

Forming cutters are used to produce tapers when the work is rigid enough or can be supported well enough to withstand the heavy cut. The roller back rest taper turner can be set quickly for size by means of a graduated dial, and the angle of taper is controlled accurately by a taper guide bar. As the tool advances toward the headstock, the cutter and the rolls recede to produce the taper. This tool produces the same burnished finish that is obtained with single cutter turners, and is ideal for long tapers that must be accurate.

Taper attachments can be provided for the cross slides of all universal turret lathes, whether of ram or saddle type. They also can be provided for the cross sliding hexagon turret on saddle type machines. These attachments can be set to produce internal or external tapers and, when not in use, do not interfere with normal operation of the lathe.

To determine the proper direction of feed for a taper cut we must consider two factors: (1) the direction of the back pressure from the cutter resulting from the cut taken, and (2) the movement of the cross slide required to produce the taper. The cross movement of the cross slide must be in a direction opposite to the direction of the back thrust from the cutter. When you have this condition, both the pressure from the cut and the longitudinal movement of the slide will force the sliding block in the attachment against one side of the guide plate. If you do not have this condition, the back pressure of the cut will pull the sliding block to one side and the longitudinal movement will putt it to the other, thus causing the steps often found on taper work.

To maintain and to duplicate accurate sizes when using the taper attachment with other tools in a set-up, it is necessary to do three things: First, the attachment must be located accurately in the same position in relation to the cross slide each time it is used; second, the cross slide must be located in exactly the same spot on the bed when the extension rod is clamped and when the binder screw is loosened; third, when the binder screw is tightened and the extension rod is loosened, the cross slide must be in the same position as in the first step.

Gage Locates Attachment

To accurately locate the attachment in relation to the cross slide it is good practice to make a gage bar and lay it between the clamp screw and the cross slide. Move the slide along the attachment until pressure against the end of the gage holds it firmly in place. To locate the cross slide before clamping the extension rod, a machine stop may be used.

Taper threads, either internal or external, can be cut accurately when using the taper attachment in connection with a leader-and-follower or with a lead screw thread chasing attachment. Special contours can be produced by using contour plates in place of straight guide plates in taper attachments. With these plates two or more angles or radii can be produced.

From a forthcoming book on turret lathe tooling.

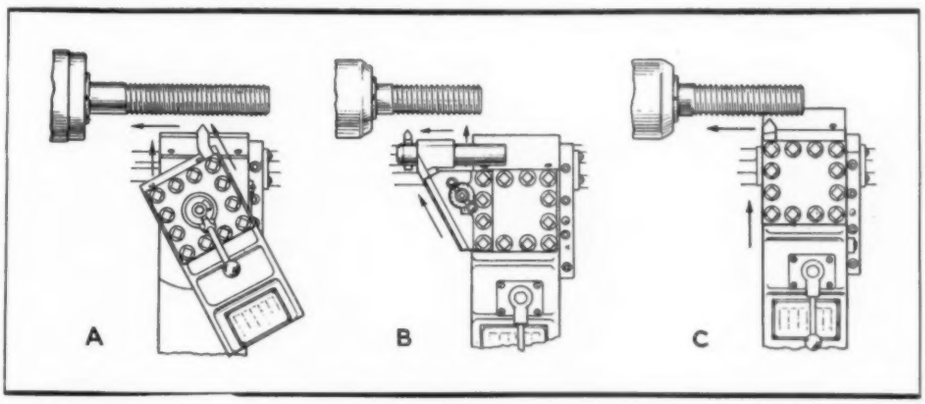


Fig. 37—Two methods are used for feeding the tool when chasing threads with a single-point cutter. At A and B the tool is fed at an angle while roughing, then fed in straight for finishing. More skill is required for the method shown at C, where the operator supplies a "drag"

Aviation's "Rubber Stamp"

BY HENRY E. GUERIN, FACTORY SUPERINTENDENT, DOUGLAS AIRCRAFT COMPANY

I—The Guerin process reduces the cost of dies. It makes available the use of hydraulic presses on limited lots of work

EARLY IN THE HISTORY of the transport plane it became obvious that better airplanes could be built for less money if they were made of metal, specifically, the light alloys of aluminum used in sheet form. Various structural forms were tried, various tools perfected for working aluminum sheet, but for a long while the laborious, costly and more or less unsatisfactory practice of hand forming dominated the metal shop.

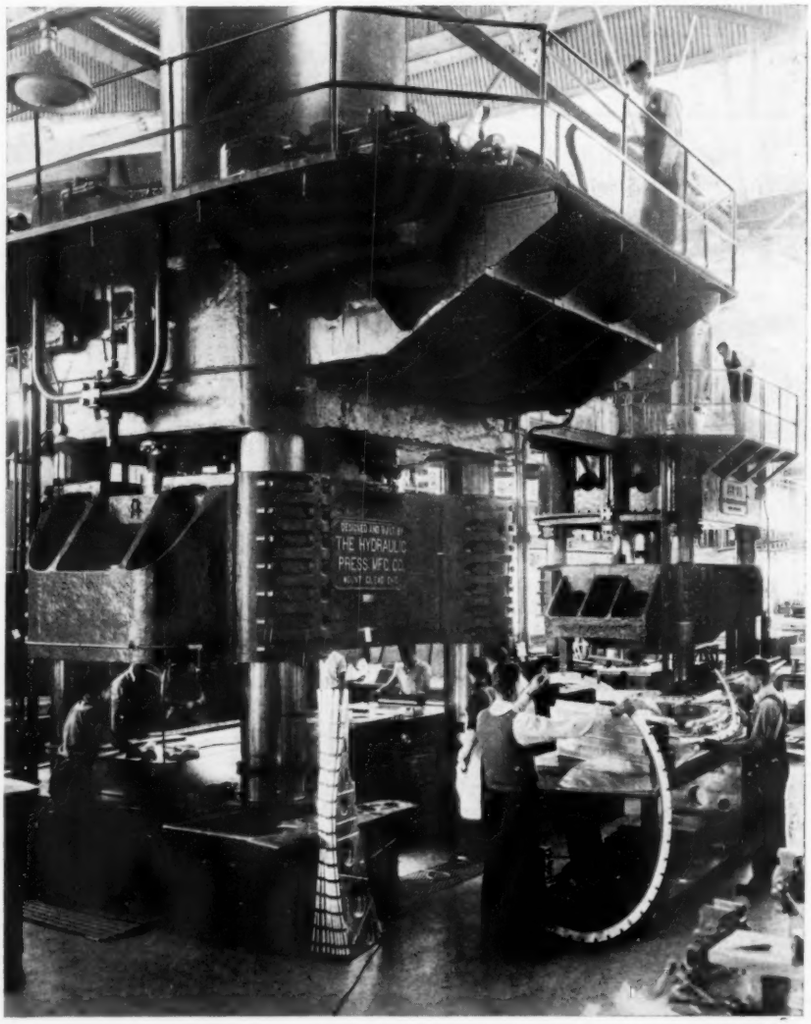
Hand working by means of hammering, sawing and filing, was given a "crutch or two" in hand directed machines for power-hammering sheet material to the desired form and nibbling machines for cutting shapes to a pattern. But this was still not striking at the heart of the problem through development of a precision production technique.

The drop hammer method was adapted to aircraft work and proved a great boon to production men. This tool fulfills aircraft needs as to low cost of dies, permitting economical application to small production runs. But the drop hammer is not a precision tool, or is it really a high-speed tool. Many sheet-metal operations can be performed in a press but not in a drop hammer.

Until the development of the Guerin process the press, at least as so widely used in the automotive industry, could not be used for aircraft because of the prohibitive cost of iron or steel dies compared to the number of parts to be formed. In aircraft work, parts are made in relatively small quantities, perhaps a few hundred of any one part, as compared with many thousands, even millions, of identical parts stamped out in auto factories.

In considering this problem I was fortunate in striking upon one of the few new ideas in metal-working introduced in the aircraft field. Most of our tools, such as the drop hammer, have been adapted from other industries. In the Guerin process we have used the hydraulic press, much as it has been widely used elsewhere, but our process relates to the method of pressing, rather than to the press itself. We first considered every known form of pressing in an effort to get away from the prohibitive cost of hard metal dies. Such ideas as hydraulic pressing, using a fluid within a closed die, as is done for certain kinds of small work of an intricate nature, were considered and abandoned as unsuitable. Yet our studies convinced us that, if we were to circumvent the use of mating dies of hard metal, it would be necessary to adapt the hydraulic die process to our needs in some fashion.

For a while this resulted in a mental guessing game something like, "What has hydraulic qualities but is not hydraulic?" We needed a material that was incompressible, that would flow with all the properties of a true fluid under pressure, yet which had none of the undesirable qualities of a fluid when applied to our special



In the foreground is the 5000-ton press used by Douglas for the Guerin process. A similar press of 2000-ton capacity is shown in the background

problem. Out of this mental travail came the magic word "rubber," a material which has come to occupy an important place in industrial life.

Rubber appealed to us because it is available in a wide range of physical properties. When properly confined, it acts like a restrained fluid, exerting equal pressure in all directions. Rubber can be easily handled in mats, pads or blocks of almost any required shape or thickness. It can be confined without great difficulty, even when subjected to terrific pressures.

It has been a long path from the original idea to its current application. An example is the use of the Guerin process for blanking operations, even of stainless steel, greatly reducing time and cost of certain profiling work. Also, we have been able to apply the process to the hot forming of sheet magnesium alloys.

The Guerin process has demonstrated its value to the industry in other ways than merely as a fast, economical medium for making airplane parts from sheet metal. For example, its use has brought improvement in aircraft construction detail design. Elimination of complex riveted assemblies, the use of stiffener angles, doublers and gussets has been accomplished through the ability to form beads, deep-drawn lightening holes and deep-formed sections that achieve optimum strength-for-weight factors. Engineering design, taking full advantage of the Guerin method, has eliminated hundreds of small parts, which added weight and cost to the former construction. Well established engineering principles have been adapted for use in calculating structural stresses of Guerin process products. One important engineering application is the Vierendeel Truss theory, which has been made feasible for airplane structures by the simplicity and economical tooling.

The Guerin process employs a rubber pad that is fixed in a container attached to the moving platen or pressing ram of the press. This container, usually a casting, is approximately 1 in. deeper than the thickness of the rubber pad used, forming a recess, the sides of which extend down beyond the rubber. On the bed of the press is a pressing block, usually the approximate thickness of the rubber, corresponding with the recess in the container. As the container moves downward, the pressing block enters the recess and forms a semi-sealed chamber in which the rubber is confined. The projection of the container, below the surface of the rubber pad as well as the thickness of the rubber, vary with the work for which the equipment is designed. For example, if the form block, were 4 or 5 in. thick, a 1-in. projection would not permit the pressing block, on which the form block is placed, to meet the container projection before the rubber began its displacement, which takes place when the die is forced into the rubber. The thickness of the rubber pad must be sufficient to permit this displacement. The die must be permitted to push into the rubber pad without striking "bottom" on the container within which the rubber is confined.

Rubber, being a plastic material and yet having the properties of a liquid insofar as compressibility is concerned, is displaced when meeting a solid object such as a form block or

Blanking, forming and punching most of the holes in these typical sheet-metal aircraft parts reflects the versatility of the process

die. This displacement of the rubber makes the Guerin process useful; it causes the full pressure, applied by the press ram and built up within the container, to exert itself evenly in all directions on the exposed surfaces of the form block, resulting in a forming operation that cannot be accomplished with mechanical devices which depend on punches and dies and on a direct vertical or horizontal motion for the pressure.

For forming, the most practical adaptation of the Guerin method comes through grouping dies of comparable size on the pressing block, eliminating concentration of pressure on certain points in the container caused by the higher projection of unevenly selected dies, and permitting simultaneous pressing of a large number of parts. This problem does not arise in cutting, as primary blanking operations are performed on flat sheets with cutting dies normally but $\frac{3}{8}$ in. thick.

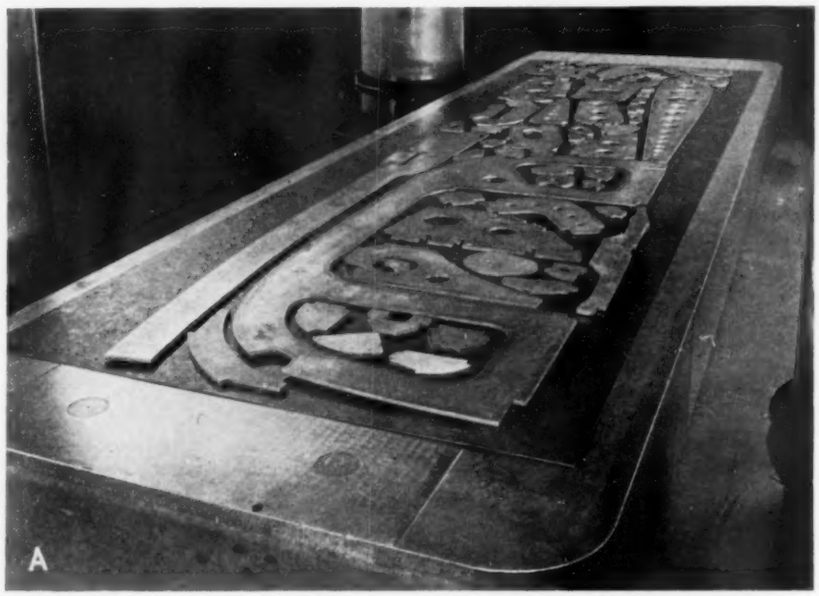
Cutting dies are usually mounted on a gang cutting plate of sheet metal approximately $\frac{1}{32}$ in. thick, which facilitates loading and scrap removal. Such a gang plate is usually laid out to utilize a stock sheet of production material, although smaller sheets may be used. Where variable thicknesses of material, in accordance with engineering requirements, make it impracticable to group a set of dies on a full size gang plate, smaller layouts are developed.

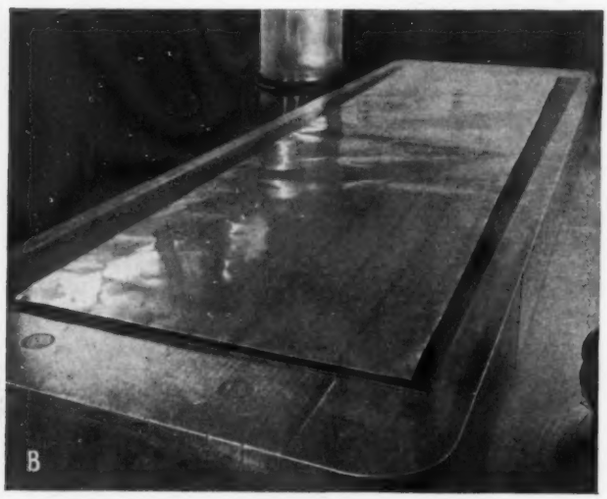
The biggest advantage of the gang plate is its saving of material. Cutting blocks that are well arranged and nested on the gang plate leave a minimum of scrap; they can be placed closer together and the arrangement given more careful study than when the blocks are placed at random or when the material is cut from individual rectangular-shaped pieces to be blanked to the shape of the part.

In addition to blanking flat sheets, operations often involve combined forming and cutting dies, or cutting of parts previously formed. These operations usually require odd shapes and sizes of dies and are normally done in conjunction with forming operations involving blocks of similar size. There is no particular problem in combining forming, forming and cutting, and straight cutting all in a single press layout, which serves to illustrate the adaptability of this process to production work. In a recommended installation the press is sufficiently large, and the container is of such size, as to permit simultaneous cutting and forming work even though reasonably large form blocks may be used at one end of the layout, and $\frac{3}{8}$-in. cutting blocks at the opposite end.

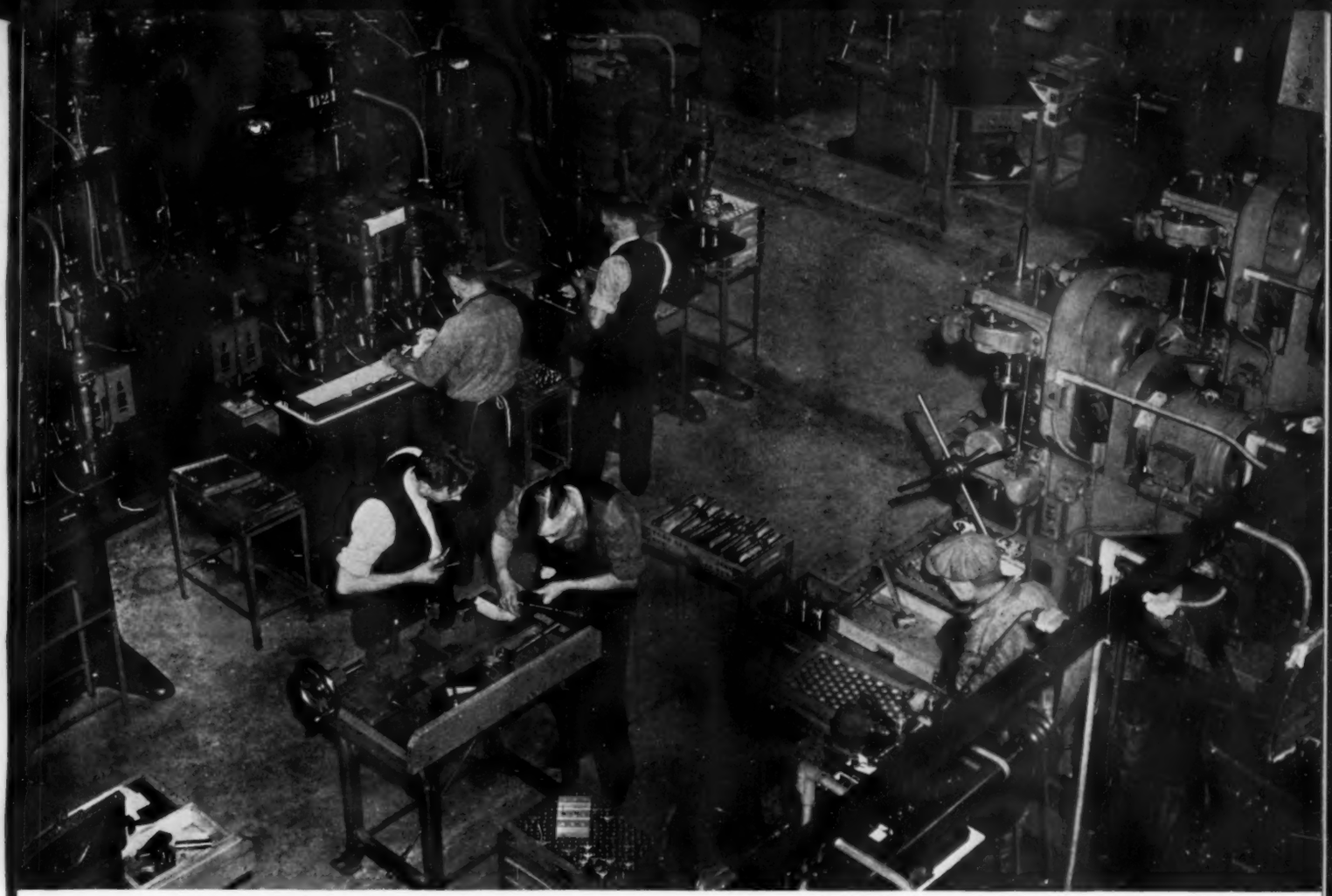
The use of loading tables to shuttle the tools and the material to and from the pressing block increases the efficiency and quantity of production from any type of press; it also reduces hazard to the workman and decreases fatigue. Such installations are being employed in a number of foreign countries as well as in the United States by licensees of the Guerin process.

Mr. Guerin will conclude the description of his process in an early number.





Three steps in a gang cutting set-up illustrate: (A) nesting the cutting blocks to keep scrap to a minimum, (B) placing the aluminum alloy sheet over the blocks, ready for shearing, and (C) the clean work obtained, immediately after cutting

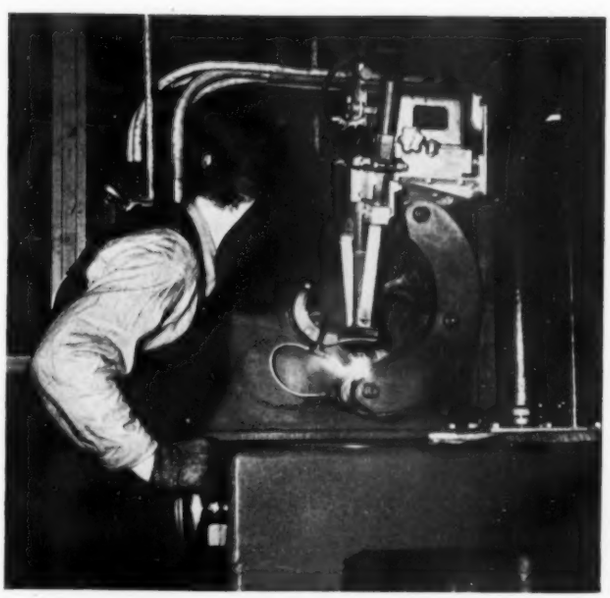


The famous Bren light machine gun is a basic element in Canadian defense preparation plans. Two inspectors in the foreground are checking accuracy of parts in the drilling department of the gun factory in Ottawa

Passed by Canadian censor

First pictures from Dominion give glimpses of how Canada manufactures airplanes, machine guns and shells for World War II

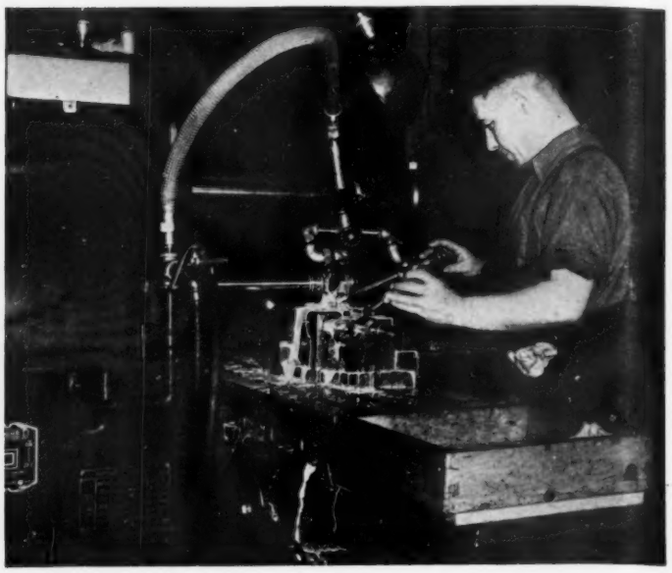
THESE ARE BUSY DAYS in Canada. In the first year of war, the Dominion will spend around $500,000,000. Already $140,000,000 worth of army and plant equipment has been placed by the government. Factories are being expanded, new tooling installed, skilled men hired, new men trained. Manufacturers are acquainting themselves with the technique of ordnance production by means of educational orders. Many have substantial war contracts. Should the war suddenly be intensified, the Allies will count even more heavily on Canada for help. These three pages of pictures, the first to be released by the government, show her industry starting to do her part in defense of the Empire.



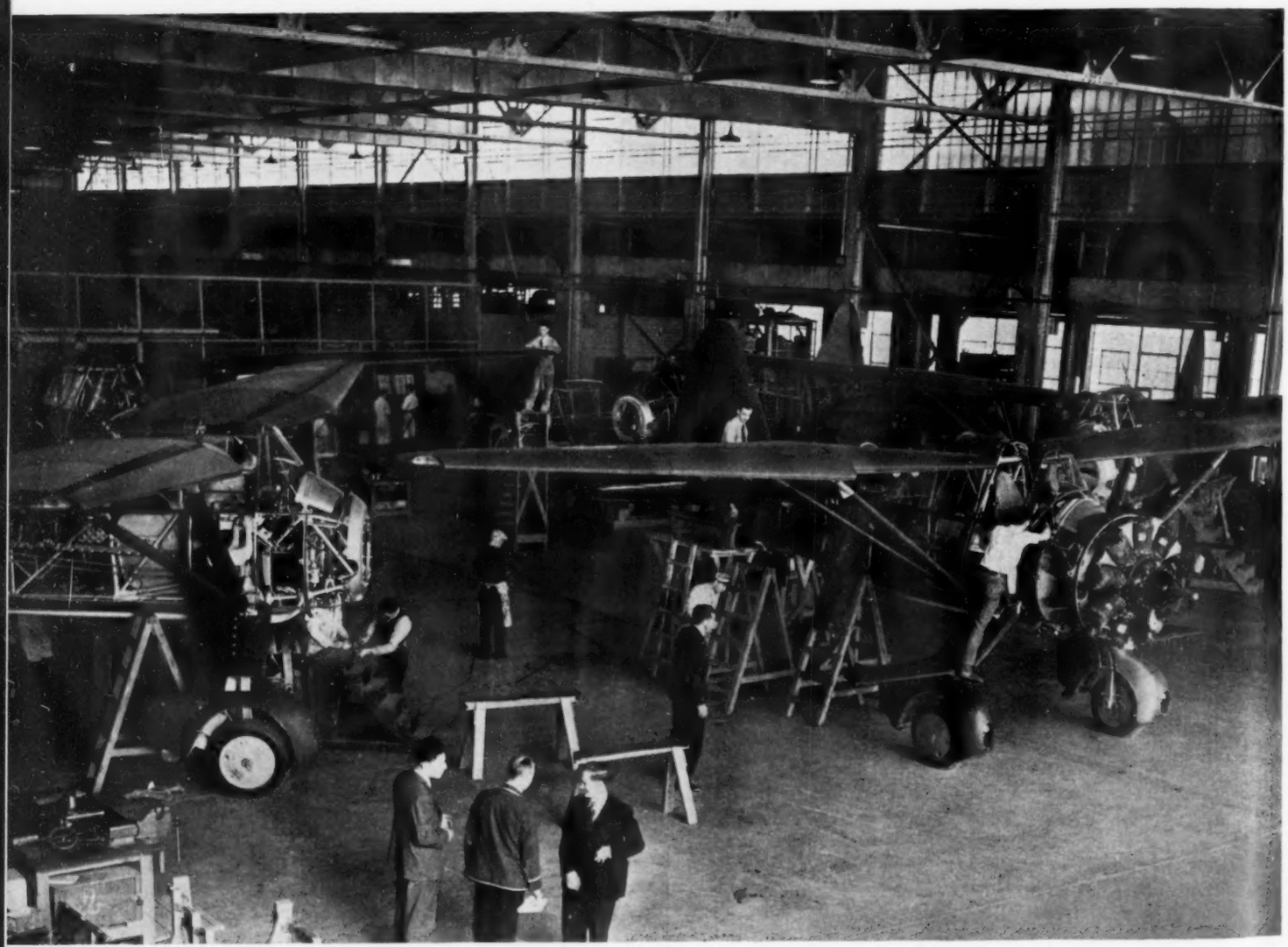
Welding plays a vital part in forming magazine clips for Bren guns. Special fixtures help boost production

First Pictures from Dominion Give Glimpses of How Canada Manufactures

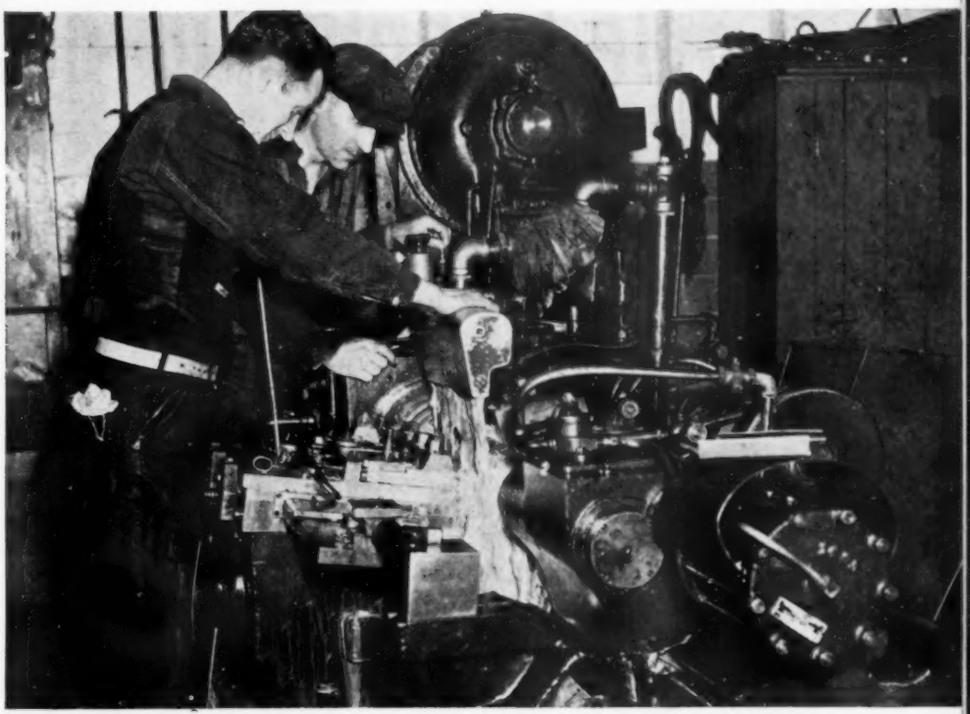
Various subassemblies require considerable hand labor. Here acetylene welding aids in making magazine clips



Milling machines equipped with special fixtures perform various operations in turning out magazine clips

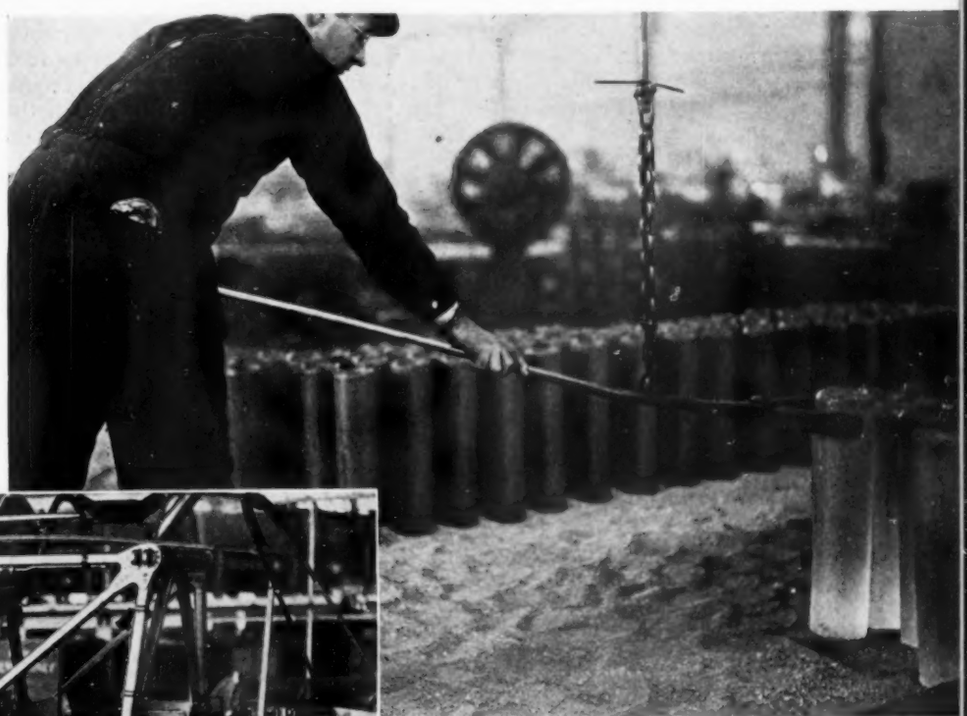


Lysander bombers are being rushed to completion in the final-assembly area of this Canadian aircraft plant



Equipment for turning shells includes an automatic lathe, above. Multiple tooling set-ups permit several operations to be performed simultaneously

Shells are given a final check with "go" and "not-go" gages. They are afterwards weighed and painted



Red-hot shell casings are set aside to cool after annealing "in one of Canada's largest munitions plants"

Electricians install wiring throughout the hull of this Lysander bomber before the metal fairing is applied

Deep holes in hot plates

Much of the success in bonding plywood depends on accuracy in machining hot plates and bases for the high-pressure forming and curing presses

DEVELOPMENT of water-proof resin glues for bonding plywood veneers is opening new fields for the use of wood. Much of the success in the actual bonding depends on the forming and curing presses, developments in which have kept pace with other improvements in plywood manufacture.

Williams, White & Company, manufacturers of heavy machinery for 85 years, build presses for curing plywood in any plate size from 10x12 in. to 64x150 in. Among the vital parts of these presses are the steel hot plates between which the sheets of veneer and glue are pressed and cured. Uniform distribution of heat (300-400 F.) over the entire area is obtained by drilling $\frac{7}{8}$-in. holes through the plates in two directions, thus providing continuous steam travel.

One of the major problems in making the presses is the deep drilling of these hot plates. In some sizes it is necessary to use drills as long as 48 in. A high-speed drift drill is used to start the holes, which are completed with Celfor high-speed drills. Soluble oil coolant is forced past the drill tip by an independent motor-driven Ingersoll-Rand unit. One of the illustrations shows the individual nozzle arrangement for each drill.

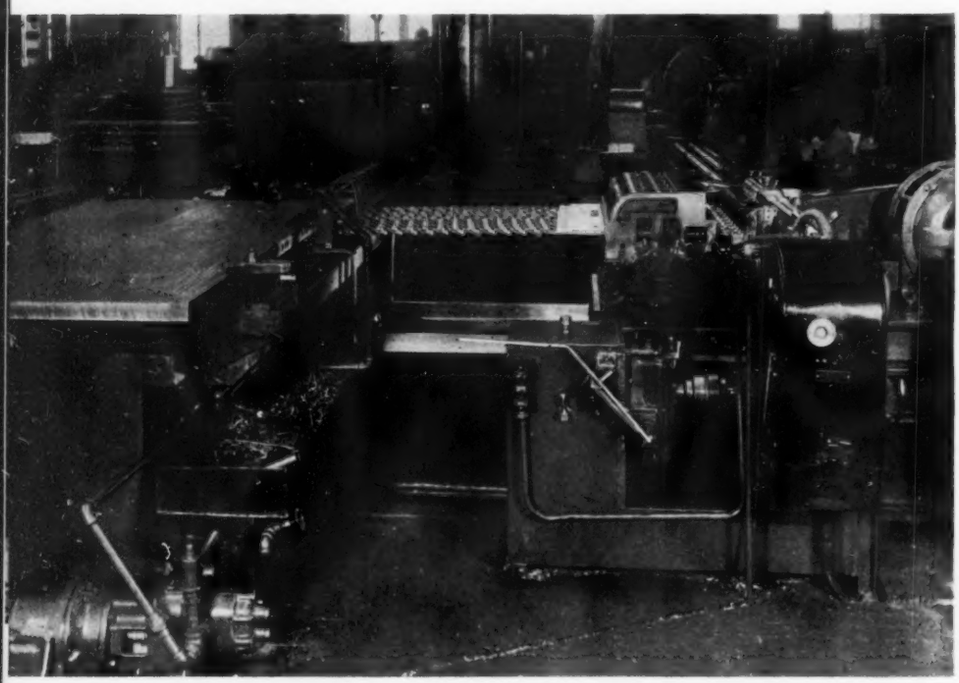
The drills are driven by a special machine designed and manufactured by Williams, White & Company, using Moline Tool Company spindle heads and an Oilgear hydraulic feed. The machine drills up to twelve holes simultaneously in sizes up to $1\frac{1}{4}$ in. diameter. It has four spindle speeds while the hydraulic unit provides varying rates of feed quickly by lever control without stopping the machine and rapid traverse for withdrawing the drills. Holes are drilled halfway through the plate in one setting, the work-table having screw-feed traverse. The plate is then reversed, and the holes are finished from the other side. Alloy steel plates were substituted for mild steel since they warped less because of heating in drilling and allowances for finish machining could be reduced.

These plates are about $2\frac{1}{4}$ in. thick before machining. Silicon-killed steel is used because it is free of seams and porous spots which would cause leakage.

Roughly, the routine on manufacturing these plates includes the following steps:

1. Rough cut both sides of plates in planer.
2. Drill steam passages in both directions in the specially designed machine described below.
3. Drill holes for hangers and steam-pipe fittings in a radial drill. A deep rectangular pit slightly wider than the plate is built into the floor alongside the machine base to keep the drill head at a reasonable height.
4. Tap all holes in radial drill using standard jigs to hold the plate on end for this operation. Threads are gaged accurately to assure steam tightness.
5. Finish cut surfaces in planer. Plates are held to an accuracy of 0.002 in. in thickness and flatness. By proper tool grind and use of slow speeds (10 to 15 ft. per min.) a mirror polish is achieved. Only a few thousandths of metal are removed in the final operation to get the high polish desired. The tools are ground so that the action of cutting is one of shearing the material away without tearing it.
6. Inspection for thickness and finish. This is done right on the planer and if the piece does not pass inspection additional work can be done without delay.
7. Plug open ends of steam holes with socket-head pipe plugs.
8. Inspection for any scratches or mars in the surface of the plate.
9. Assembly. If the plates are not assembled immediately they are oiled and stacked with sheets of paper between to prevent marring the polished surface.

When the shop is working at high production, two planers are used 24 hours per day to machine these plates.



Drilling deep holes for steam passage through hot plates for plywood presses was a major problem. Twelve holes are now drilled simultaneously with this multiple-spindle machine using high-speed drills and pressure-fed coolant

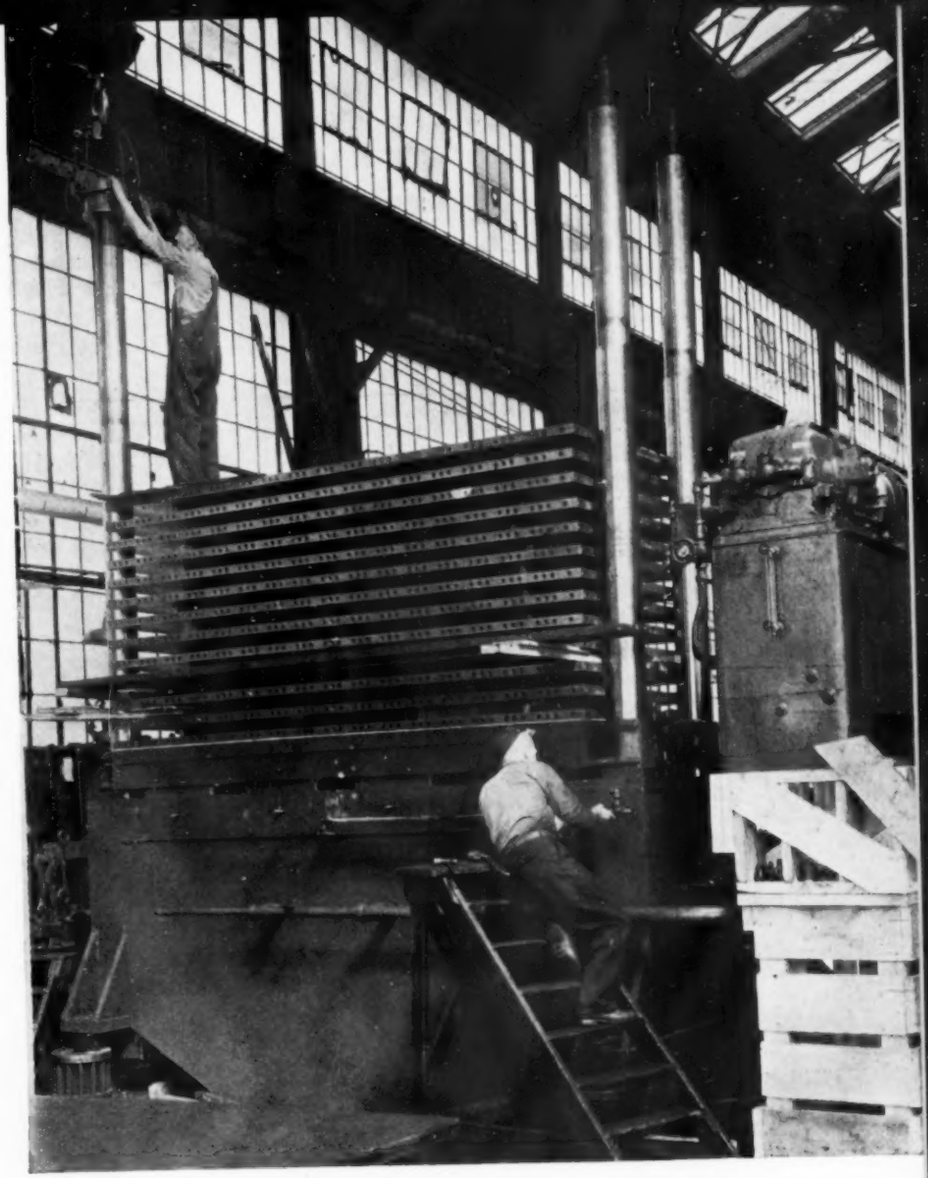
One of the planers is not as fast as the other. To compensate for this and to bring production of each in line, as many as five cutting tools are used at one time on the slower planer. This is done by putting two tools in each of two heads and one tool in the side head, the edges of the plates being machined in the same planer.

The frames of the hot-plate presses may be either of one-piece construction or of the strain-rod type with welded crowns and bases; in some cases the parts may be of composite cast and welded structure. Williams, White has its own foundry and recently installed portable Lincoln and Hobart arc-welding equipment for the manufacture of these composite structures.

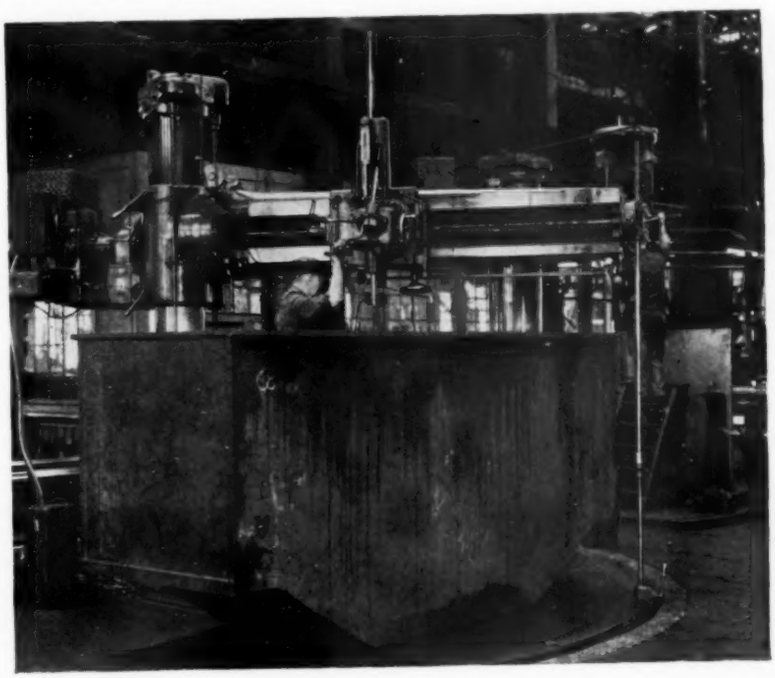
The presses are made for such a variety of plywood sizes and production rates, which vary from plant to plant, that they can be standardized only according to basic design. Consequently, they are built on a contract-shop basis, which is no handicap since other heavy machinery such as bull-dozers and tube-bending machines are made in the same shop.

Radial Drills Raised

Thus the machine tool arrangement is similar to that used in any other contract shop. Primarily, general-purpose machines such as planers, radial drills, millers, lathes and portable welding units are used with one or two exceptions. Such exceptions involve changes in the construction of some of the standard machine tools to accommodate the size and shape of press parts being manufactured. For example, the majority of work requiring drilling was of such height and shape that the standard radial-drill construction brought the arm and head down to a level where the lower portion of travel was not being used while the upper limit was not high enough to accommodate the large pieces. The columns of all radial drills were raised by inserting a 12 to 15 in. block between the column and the base of the machine. This made available the full travel of the arm from the top to the bottom giving the drill a wider working range than the standard radial drill.



Drilled hot plates are assembled on a composite cast and welded base. A welded crown is attached to the vertical strain rods which apply pressure during the forming and curing of plywood veneers



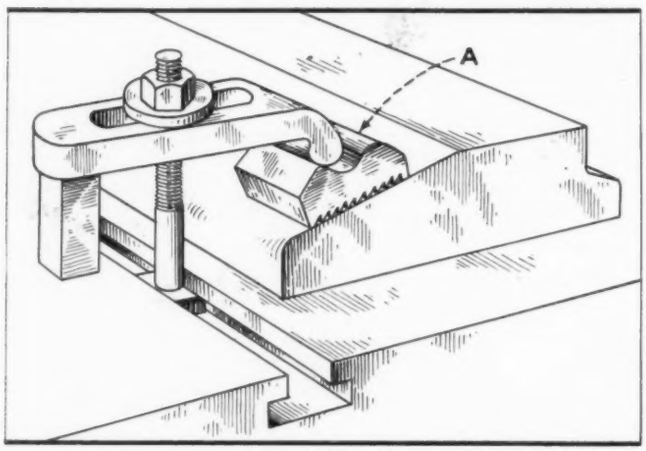
The radial drill in the foreground is used for vertical and angle drilling on this composite cast and welded press base. Holes for steam-pipe fittings are drill as shown in the background with the large hot plates resting in juts alongside the radial-drill base

IDEAS FROM PRACTICAL MEN

Serrated Pad Prevents Clamp From Slipping

By CHARLES H. WILLEY
Superintendent of Manufacturing
Hoyt Electrical Instrument Works

Recently we had to machine a quantity of work in which one of the clamps had to be placed on a sloping surface. Since we found that it was impossible to prevent the clamp from slipping, we made the serrated pad *A*. It is a block of hardened tool steel having buttress-shaped teeth on the bottom and a groove on top in which the rounded, downpointing toe of the clamp engages, as shown in the sketch. The device is very efficient and since using it we have had no trouble from the slippage of the clamp.



The clamp is held on a sloping surface by a hardened tool-steel pad having buttress-shaped teeth and a groove on top to receive the downpointing toe of the clamp

Double- vs. Single-Action Drawing Presses

By A. D. MUNDY

In looking over the descriptions of press tools that have appeared in AMERICAN MACHINIST from time to time, I have been impressed by the number of single-action presses used for drawing operations and am presenting drawings of two sets of press tools for drawing pail bottoms with the idea of pointing out the advantages of using double-action presses for all drawing operations, since the saving of cost in tool construction and maintenance is such that would warrant the use of double-action presses. The tools illustrated in Fig. 1 are for use in single-action presses, while those in Fig. 2 are for use for the same work in double action presses.

Referring to Fig. 1, it is necessary for the punch *A* to enter die *B* the full depth of the drawn shell ($\frac{7}{8}$ in.). That is bad practice and tends to shorten the life of both punch and die. The springs *C*, of which there are eight, must be cut to accurate length and holes must be drilled for them in pad *D* and punch holder *F*, which adds materially to the cost of the punch. The stripper pin *H* must be provided to make sure that the drawn shell does not stick to pad *D*. In the die section there are eight bumper pins *I* to be held to accurate length, and holes must be drilled for them in both the die-shoe and the bed plate, and for dies of each size the bed plate must have a different set of holes and pins. The studs, springs and bumper plates that go under the bed plate are not shown because their necessity is familiar to all diemakers.

When the tools are to be sharpened it is necessary to take them completely apart, which is no small job, and when punch *A* is ground, the radius must be restored to its original shape. Also, pad *D* must be faced off to maintain its correct relation to the punch. After the die has been sharpened, pad *K* must be faced off an equal amount.

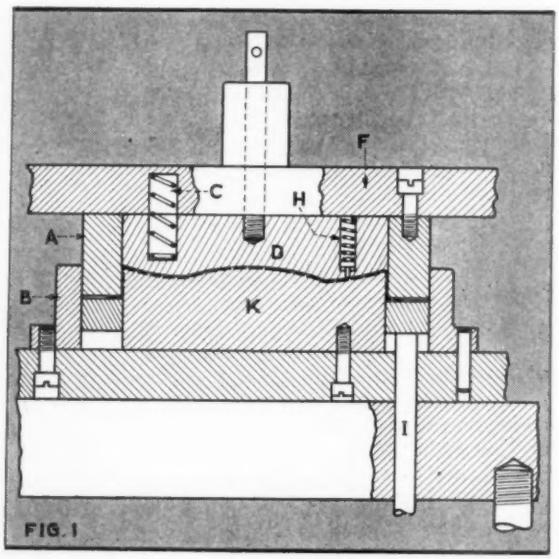


Fig. 1—Not only do tools for drawing operations in single-action presses cost more for construction than do tools for the same work in double-action presses, but their maintenance cost is greater and their life is shorter

In operation, the pressure on the blank increases as

the shell is drawn, due to the bumper springs being compressed, which is the reverse of what is desired. And as the press crank passes its lower center the spring snaps it upward, causing undue clutch wear.

Referring to Fig. 2, the tools illustrated are for use in a double-action press. There are no springs in their construction, the bank being stripped from the punch by the blank holder *A*. When the tools need sharpening, the pads *B* and *C* can be removed without taking out a single screw. The die *D* can be sharpened several times before it is necessary to face off the ring *F* or the pad *C*. No special bed plate is required.

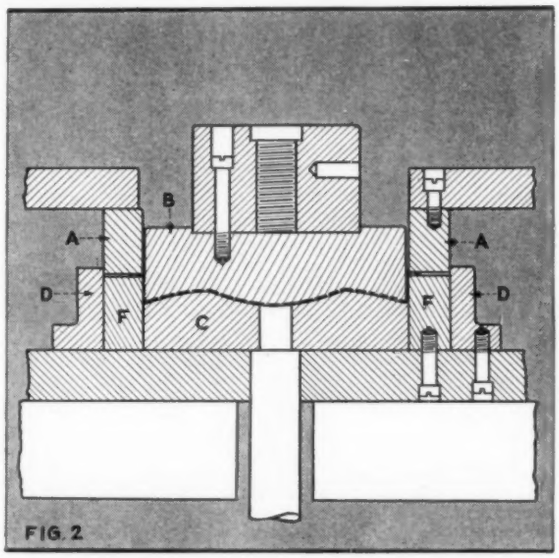


Fig. 2—Tools for drawing operations in double-acting presses can be set in less time than can tools for the same work in single-action presses, and can be sharpened without taking them apart

The set-up time for drawing tools in a single-action press is much greater than that in a double-action press. Our experience, checked over a long time, indicates that the cost of the tools shown in Fig. 1 is 20 per cent greater and that their maintenance cost is double that of the tools shown in Fig. 2. Also that their life is about 40 per cent less.

A Simple Device for Mixing Cutting Oils

By BRUCE MacINTOSH

Cutting compounds and emulsions of all kinds can be thoroughly mixed in the original containers by simply resting them on wooden rollers which are mounted on steel shafts. One roller is driven by a belted pulley, while the other is revolved by the friction of the container itself. The rollers are 4 in. in diameter and 4 ft. in length. They are made in halves, grooved lengthwise for the shafts, glued together, pinned on the shafts and then turned on centers. The bearings for the shafts are high enough above the floor to give clearance to the pulley.

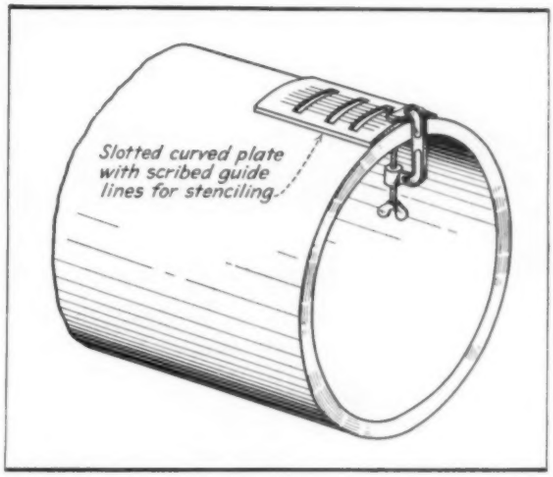
Discussion of Aids for Hand Stamping

By ROBERT S. ALEXANDER

Although lines extended beyond a stencil as a guide for spacing letters to be stamped on metal (*AM*—Vol. 83, p. 688) give excellent results on flat surfaces, the method described by M. H. Ball is not suitable for cylindrical surfaces. The writer had to jumble letters near the end of a large cylinder for which three lines of instructions had to be stamped, instead of the single line as described by Mr. Ball. Therefore, I devised a metal guide that lowered the time of stamping and attained uniform spacing.

The guide was made of $\frac{1}{8}$-in. sheet metal and was bent to the outside radius of the cylinder. Before bending, three slots were cut in the guide to correspond with the lines of stamping and of a width that the ends of the stamps would fit snugly therein.

Then, using a variation of Mr. Ball's idea, the center distance of the letters was measured and corresponding vertical lines were scribed both above and below the three slots, as shown in the illustration, so that by inserting the business end of each stamp and



Letters on cylindrical surfaces can be aligned by placing the stamps in close fitting slots in a guide; the letters are spaced by centering them with the vertical lines.

centering it by the scribed lines the letters were evenly spaced. With the guide secured to the end of the cylinder by a C-clamp there was no need to worry about either the spacing or the alignment of the letters. All that was necessary was placing the required stamp in the proper slot, a little care in centering—and a blow of the hammer.

By MATTHEW HARRIS

Not all letters and numerals in certain combinations should be in accurate alignment. If letters and numerals having rounded bottoms, such as C, G, J, O, Q, S, U and 3, 5, 6 and 9, are placed in combination with characters having flat bottoms, their

rounded bottoms must be slightly below the base line. Otherwise an optical illusion will be set up and they will appear to be out of alignment.

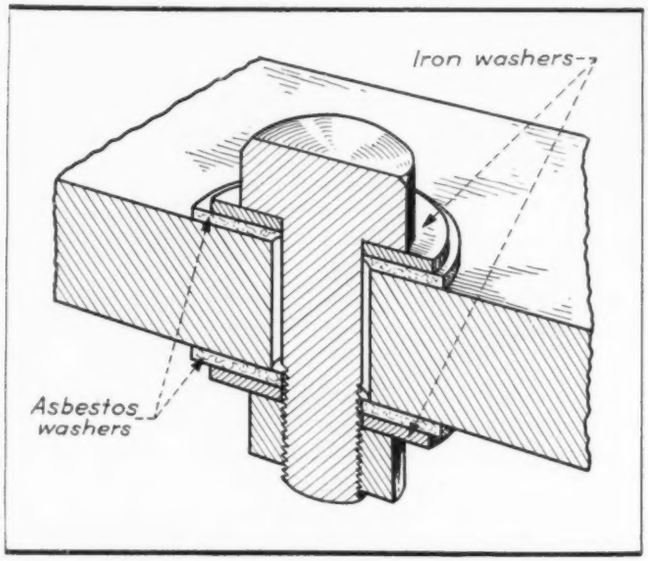
The amount the rounded bottoms of letters or numerals should extend below the base line, depends upon the style of the characters. For instance, the bottom of the capital letter C does not extend below the base line as far as does the capital letter O because the serif tends to give an entirely different effect. This should be taken into consideration when using guides for metal stencils.

One Method for Reducing Oversize Holes

By JOHN E. CORRIGAN

While it is easy enough to increase the size of a hole, it is a far different matter to make it smaller. However, holes in jig bushings, collars and other like objects can be reduced $\frac{1}{16}$ in. or more, depending on the diameter and metal through which they pass.

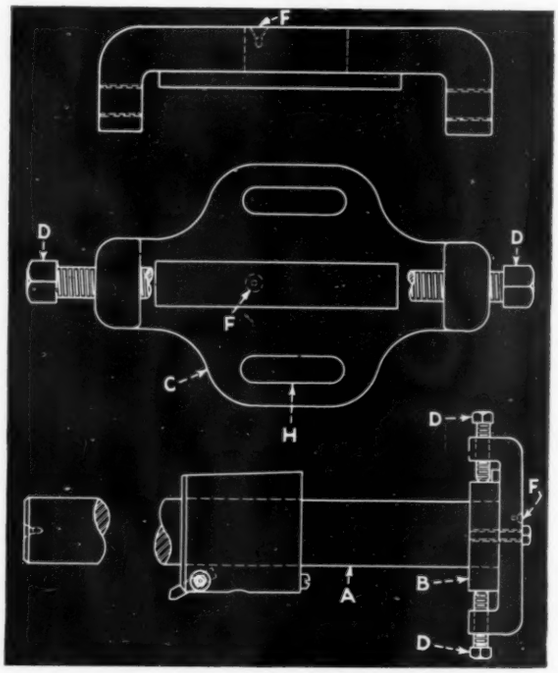
To reduce the size of a hole, cut two washers out of asbestos not less than $\frac{1}{8}$ in. thick. Select a bolt that will go through the hole, put an iron washer on it



Oversize holes can be made smaller by heating and quenching the work, but the holes must be closed against the entry of the quenching water

and over the iron washer put one of the asbestos washers and pass the bolt through the hole. Put the second asbestos washer on the bolt and put an iron washer on top of it. Put on the nut and screw it up tight, the assembly being shown in the sketch. Heat the work to a red heat and quench it. If the hole is $\frac{3}{4}$ in. or less in diameter and is 0.003 in. oversize, the work should be quenched in warm water, but if it is more than 0.003 in. oversize it should be quenched in ice water. If it is found that the hole has been made too small, it can easily be reamed or ground.

What happens is this: As the hole is closed by the asbestos washers, the quenching water can not get into it and therefore its wall remains at a red heat for some time. Since the outside of the work is cooled first and fastest, it shrinks and pinches the soft metal in the wall of the hole evenly before it can cool to a degree where contraction is no longer possible.



An adjustable plate attached to a collar on the end of this boring bar has a countersunk center hole; it can be offset to bore taper holes

Boring Bar for Taper Holes

By MARTIN H. BALL

Taper holes for piston rods in the rams of steam hammers sometimes become distorted by heavy work and must be rebored. The job is usually done in a vertical boring mill, but when such a machine is not available resort must be had to an engine lathe and a boring bar that is adjustable for boring taper holes. Such a bar is shown in diagram in the illustration. In addition to being a conventional bar having a sliding head carrying the cutting tool and traversed by a screw operated by the well-known star wheel, it has adjustment for boring tapers.

Referring to the illustration, the bar *A* is provided with the collar *B* keyed to the end toward the tailstock and the adjustable plate *C* by which the bar can be offset by the screws *D*. The adjustable plate has a countersunk center hole at *F* and is clamped to the collar by two capscrews passing through the slots *H*. In the set-up, the toolblock is removed from the cross-slide and the ram is clamped to the wings of the carriage, resting on parallels that bring its bore in alignment with the lathe centers, the small end of the taper bore being toward the headstock.

Corrections for Long Addendum Spur Gears

BY JOHN APELSKOG

IF ONE OF TWO meshing gears of standard design has less than 32 teeth, interference occurs unless the teeth are undercut. This becomes serious when 25 or fewer teeth are used. By applying the "long and short addendum" method of gear design, interference and undercutting are eliminated by lengthening the addendum of the pinion teeth with a corresponding shortening of the gear-teeth addendum. The whole depth of the teeth and the center distance of the gears remain the same as in the standard design; however, if the center distance is not important it is only necessary to increase the addendum of the pinion teeth. Formulas have been developed in connection with this method of gear design which give the full correction for pinion and gear teeth addenda to eliminate completely both interference and undercutting.

For gears with a small number of teeth, full correction may be undesirable because it gives too pointed a tooth. Half corrections are entirely practical, resulting in minimum undercutting and a tooth almost as strong as one fully corrected. This is especially true of very small gears.

For this half correction, the amount the addendum of the pinion teeth must be lengthened, and the amount the gear-teeth addendum must be shortened if it be desired to retain exact center distance between the gears, can be obtained from the formula

$$\text{Correction} = A - \frac{PD}{2}(\sin\theta)^2$$

where A is the normal addendum, PD is the pitch diameter and θ is the pressure angle.

For example, if 24 is the diametral pitch of a six-tooth pinion having a pressure angle of $14\frac{1}{2}$ deg., a normal outside diameter of 0.3334 in., and a normal addendum of 0.0417 in., the correction would be

$$0.0417 - \frac{0.25}{2} \times 0.25038^2 =$$

0.0338 in.

Thus the corrected pitch diameter will be $0.25 + 0.0338 = 0.2838$ in., and the corrected outside diameter of the pinion will be $0.3334 + 0.0338 = 0.3672$ in. If it should be necessary to retain the center distance of the normal gears, this correction of 0.0338 in. would have to be subtracted from the normal pitch and outside gear diameters.

Such corrections for spur gears with a $14\frac{1}{2}$ deg. pressure angle, 5 to 25 teeth, and 8 to 48 diametral pitch are given in the accompanying table. For gears having a diametral pitch other than those given in the table, the correction is obtained by dividing the constant in the second column by the diametral pitch given.

These corrections for small spur gears give tooth shapes which have been found practical in the manufacture of precise instruments.

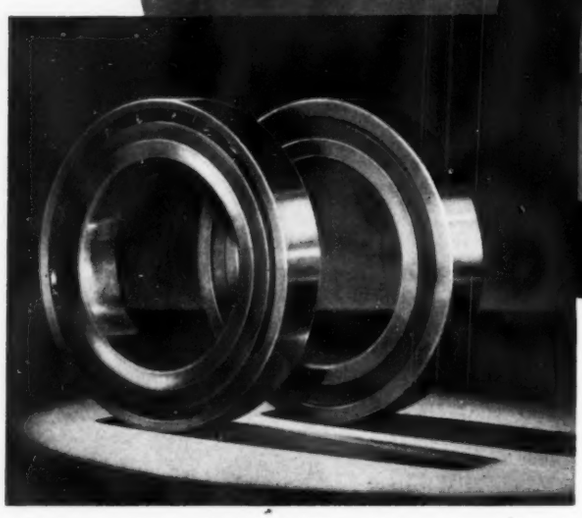
ADDENDUM CORRECTIONS FOR SPUR GEARS WITH 25 TEETH OR LESS

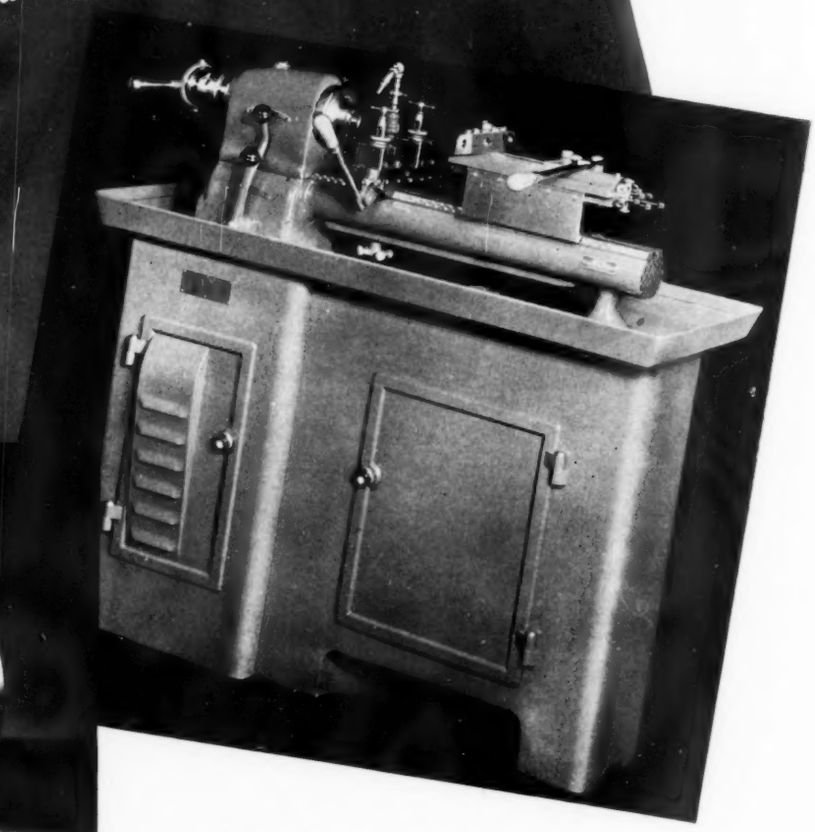
Number of teeth	*Constant**	Diametral pitch — Correction**									
		8	10	11	12	14	16	20	24	32	48
5	0.8433	0.1054	0.0843	0.0766	0.0703	0.0602	0.0527	0.0422	0.0351	0.0263	0.0176
6	0.8110	0.1012	0.0811	0.0737	0.0675	0.0579	0.0507	0.0405	0.0338	0.0253	0.0169
7	0.7810	0.0976	0.0781	0.0710	0.0650	0.0557	0.0487	0.0390	0.0325	0.0244	0.0162
8	0.7490	0.0936	0.0749	0.0680	0.0624	0.0535	0.0467	0.0374	0.0312	0.0234	0.0156
9	0.7185	0.0898	0.0718	0.0653	0.0598	0.0513	0.0448	0.0359	0.0299	0.0224	0.0149
10	0.6875	0.0859	0.0687	0.0624	0.0573	0.0491	0.0428	0.0343	0.0286	0.0215	0.0143
11	0.6550	0.0819	0.0655	0.0595	0.0546	0.0468	0.0408	0.0327	0.0273	0.0204	0.0136
12	0.6240	0.0780	0.0624	0.0567	0.0520	0.0445	0.0390	0.0312	0.0260	0.0195	0.0130
13	0.5925	0.0741	0.0592	0.0538	0.0494	0.0423	0.0370	0.0296	0.0247	0.0183	0.0123
14	0.5610	0.0701	0.0561	0.0510	0.0467	0.0400	0.0350	0.0280	0.0234	0.0175	0.0117
15	0.5300	0.0662	0.0530	0.0482	0.0441	0.0378	0.0331	0.0265	0.0221	0.0166	0.0110
16	0.4985	0.0623	0.0498	0.0453	0.0416	0.0356	0.0312	0.0249	0.0208	0.0156	0.0104
17	0.4671	0.0584	0.0467	0.0424	0.0389	0.0334	0.0292	0.0233	0.0195	0.0146	0.0097
18	0.4358	0.0545	0.0436	0.0396	0.0363	0.0311	0.0272	0.0218	0.0182	0.0136	0.0091
19	0.4044	0.0506	0.0404	0.0367	0.0337	0.0289	0.0253	0.0202	0.0168	0.0126	0.0084
20	0.3731	0.0466	0.0373	0.0339	0.0311	0.0266	0.0233	0.0186	0.0156	0.0117	0.0078
21	0.3417	0.0427	0.0342	0.0311	0.0285	0.0244	0.0213	0.0171	0.0142	0.0107	0.0071
22	0.3104	0.0387	0.0310	0.0282	0.0258	0.0222	0.0194	0.0155	0.0129	0.0097	0.0065
23	0.2790	0.0349	0.0279	0.0253	0.0232	0.0199	0.0174	0.0139	0.0116	0.0087	0.0058
24	0.2477	0.0309	0.0248	0.0225	0.0206	0.0177	0.0154	0.0124	0.0103	0.0077	0.0052
25	0.2164	0.0270	0.0216	0.0196	0.0180	0.0154	0.0135	0.0108	0.0090	0.0067	0.0045

* This constant divided by diametral pitch gives the addendum correction for gears of any diametral pitch and with 5 to 25 teeth. For a gear having six teeth and a diametral pitch of 28, the correction would be 0.811/28 = 0.029 in.

** These corrections are to be added to pinion-teeth addenda, and subtracted from gear-teeth addenda, to prevent interference and eliminate excessive undercutting. If the center distance of any two gears is not important, it is only necessary to add the correction to the pinion addendum.

HIGH SPEED AND FINE ACCURACY
with Forged Precision Bearings





Hardinge High Speed Precision
Second Operation Machine.

● Extreme accuracy is of little value in any machine unless it is built in as a permanent feature.

With New Departure, preloaded, precision ball bearings, Hardinge not only achieves fine accuracy that *endures*, but these free running ball bearings are never taxed in the least by the highest speeds for which the machine is intended. New Departure, Division of General Motors, Bristol, Connecticut.

2860

NEW DEPARTURE
THE *FORGED STEEL* BEARING

AMERICAN MACHINIST REFERENCE BOOK SHEET

Recommendations for Protective Clothing

Courtesy of the American Mutual Liability Insurance Company

Protective item	*Construction*	*Type of hazard*																				
		Sparks	Molten metal	Hot materials	Heat	Hot liquids	Moisture	Acids	Alkalies	Corrosives	Slips	Falls	Falling objects	Flying particles	Sharp objects	Electric shock	Cuts	Blows	Punctures	Dermatitis	Spark explosion	Moving loads
Coats, Aprons	Asbestos	●	●	●	●									●								
	Chrome leather	●	●			●								●	●		●	●	●			
	Fireproof duck	●	●																			
	Rubber						●	●	●	●						●				●		
Coats	Wool				●																	
Aprons	Wire mesh													●	●		●	●	●			
Shoes, Boots	Reinforced toe												●		●			●	●			●
	Non-skid sole										●	●										
	Sewn sole									●						●					●	
	Wooden sole			●	●			●	●	●											●	
	Chrome leather	●	●	●	●	●	●	●	●	●				●	●		●		●			
	Rubber						●	●	●	●	●	●				●				●		
	Rubber insulated															●						
	Copper nailed heel																				●	
	Congress type	●	●	●		●																
	Wood-pegged sole															●					●	
Spats; leggings; pants; knee pads; sleeve, wrist and arm protectors	Asbestos	●	●	●	●																	
	Chrome leather	●												●	●		●	●	●			
	Fireproof duck	●			●	●																
	Glass-fiber cloth	●					●	●	●	●						●				●		
	Fiber-metal alloys	●						●	●	●			●	●	●		●	●	●			●
	Wool				●																	
	Rubber						●	●	●	●						●				●		
Gloves, mittens, hand pads, and finger guards	Asbestos	●	●	●	●	●																
	Chrome leather	●				●								●	●		●		●	●		
	Rubber						●	●	●	●						●				●		
	Rubberized cotton						●	●	●	●										●		
	Wool-lined asbestos		●	●	●																	
	Metal mesh														●		●	●	●			
	Cotton																●		●			
	Canvas																●					
Hats	Bakelite	●											●	●	●		●	●				●
	Duralumin	●											●	●	●		●	●				●
	Vulcanized fiber	●											●	●	●		●	●				●
	Cotton or wool																					●
Hats, hoods	Rubber					●	●	●	●	●						●						
	Asbestos	●	●	●	●																	

Tough Job

BUT A CINCH FOR GUN TAPS

The G. T. D. Gun Tap is always a good bet on "through" holes in stringy metals. It cuts with a shearing action, shooting the chips ahead and preventing clogging in the flutes.

Wanted: A deep thread in a specially tough steel —and rapid production vital. No time to "nurse" the tap — no time to waste changing dull or broken taps either. • The illustration shows half the answer — a sturdy G. T. D. Greenfield "Gun" Tap. Its shallow flutes provide the extra strength needed to tap deep "through" threads at high speed. • The other half of the answer is in the special angle of the gun tap point and the proper cutting oil, resulting from a G. T. D. Greenfield Engineer's study of the job — on the job.

Any manufacturer can get G. T. D. Greenfield expert tool service by writing to the address below — no obligation.

Greenfield Tap & Die Corporation · Greenfield, Mass.

Detroit Plant: 2102 West Fort St.
Warehouses in New York, Chicago, Los Angeles and San Francisco
In Canada: Greenfield Tap & Die Corporation of Canada, Ltd., Galt, Ontario

GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

On High-Nosing the Dirty Worker

THE OTHER DAY we read a plea for dirty hands. It pointed out that all of us are at the mercy of the man who fixes our plumbing, our furnaces, our telephone and our automobile. It warned, "The white collar guy has to be mighty careful about high-nosing the dirty worker these days."

And that brings us to our theme. Youngsters looking ahead should be careful not to high-nose the job of the dirty worker in favor of the white collar.

Look at men of industry to whom fame and fortune have come. In the automobile industry, Henry Ford, Bill Knudsen, Walter Chrysler and K. T. Keller are tops. For years they worked in overalls, amid grease, dirt and things mechanical. They still love nothing better than to tinker around in the shop. Dirty hands brought them success.

In steel you get the same story. Charles Schwab, Eugene Grace, Tom Girdler and Ben Fairless are eminent products of the steel mill itself, not of swivel chairs in front offices.

The machine tool industry is packed with men who came to prominence from the shop bench.

Go to America's newest industry, aviation, and you find the same thing. Glenn Martin and Donald Douglas didn't rise to leadership by pushing a pencil or by pushing a button in a quiet clean office. They were out in the shop fooling with flying contraptions. They were expert mechanics, and still are.

All of our youngsters can't become Bill Knudsens or Tom Girdlers by going into the shop instead of into the office. But many cannot better insure themselves permanent jobs and relatively high pay in the years ahead than by becoming skilled mechanics.

The public mistakenly believes that mechanization of manufacture is reducing the need for individual skill among workers. The opposite actually is the case. Everything made by machinery still has to be made first by hand. To quote Mr. Knudsen, "The process of production in America today requires more highly skilled mechanics than ever before."

Many a manufacturer sings the popular song, "What is so rare as a seasoned, all-around mechanic who really knows his business?" That song is being warbled oftener and louder than ever just now. It is repeated so much that it should be on the Hit Parade.

Our hunch is that the young man who chooses to trust his future to the shop rather than to the office, provided he has any mechanical bent at all, will not regret his decision. If he has the real stuff, ahead of him will be plenty of jobs—foreman, shop superintendent, production manager, big boss. And in all of these tasks he will have an advantage in the all-important job of handling men because of his shop experience.

It may well be that in the future the dirty worker will high-nose the white collar guy instead of the other way round.

Burnham Finney

GAGING BUSINESS

Big Spring and Summer assured in machine tool, shipbuilding and aircraft industries. Further mass purchases of machine tools expected by aircraft makers. Railroad buying expands

Thanks to unprecedented demands upon the machine tool, shipbuilding and aircraft industries, metal-working operations have been less affected by the current recession than almost any other line. Production and employment are destined to hold at a high level throughout the Spring and Summer.

Machine Tools—March bookings fell behind those of February, when the industry was flooded with orders from aircraft makers. However, a considerable number of builders and dealers report March a very good month, with domestic demand well distributed and less preponderantly aircraft. Automobile manufacturers, for one, increased their purchases. The Army and Navy continue active buyers of machine tools. Educational orders contracts, on the other hand, have not produced as much machine tool business as anticipated. Settlement of the aircraft buying program for the Allies is expected to bring further mass ordering of machine tools by the U. S. airplane industry, particularly the engine and parts people. Foreign purchases have been in chunks rather than in a steady volume. Some builders are refusing to take any more export orders for shipment this year, preferring to hold any open deliveries which they still have for any domestic business which may later develop. The Allies are said to be hesitant about awarding machine tool contracts for delivery beyond the first quarter of 1941. On many popular types of machines, the proportion of plant production allocated to foreign customers is already filled for the next twelve months. Despite an apparent "breathing spell" in incoming business, orders are still so big that no real progress is being made in cutting down backlogs.

Ordnance—Army and Navy purchases continue brisk. The War Department has contracted with York Safe & Lock Co. for $1,731,240 of ammunition, with Norris Stamping & Manufacturing Co. for $502,000 of cartridge cases and with Westinghouse for $996,913 of power and control equipment.

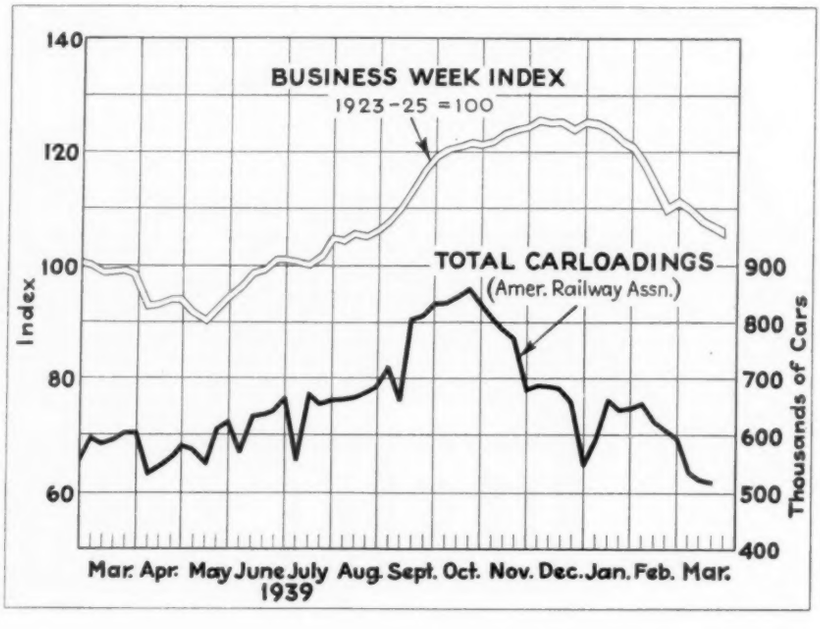
Aircraft—Allocation of further orders from the Allies for some 8,000 planes and 13,000 engines is expected this week as the result of conferences among U. S. Government officials, Allied purchasing representatives and aircraft companies. Meanwhile the industry, particularly in the engine division, is straining to turn out units as rapidly as possible and to increase capacity. Activity outside the military field is notable too. Piper Aircraft, for example, plans production of 2,500 small sport planes this year, compared with 1,800 in 1939.

Railroad Equipment—After two months during which buying was almost zero, business is looking up. Pittsburgh & Lake Erie has purchased 500 box cars each from Pullman and Pressed Steel Car. Baltimore & Ohio plans to spend $5,929,000 for 2,100 freight cars. Pending inquiries include 250 freight cars for the Nashville, Chattanooga & St. Louis, 200 refrigerator cars for Northwestern Refrigeration and 100 hopper cars for the Burlington. The courts have approved the Rock Island's proposal to buy diesel electric locomotives and passenger cars worth $1,528,000 freight cars in its own shops. Backlogs of car builders are dwindling.

Farm Implements—It is estimated $450,000,000 will be spent by farmers for implements and tractors this year, though the high income of farmers the first two months of 1940 probably cannot be maintained. Main activity is in the tractor field where new models introduced the past year are being promoted. Only new announcement is of the J. I. Case $625 rubber-tired tractor.

Steel—The downward trend of operations has not yet stopped, though normally March is one of the better months of the year. Tonnage booked is still below output so a further decline appears likely. With ingot production around 60 per cent, it is believed that the downward curve shortly will flatten out. Motor car makers have most of the steel needed for the remainder of the current model year.

Electrical Equipment—Manufacturers of big turbines, generators and other heavy equipment are extremely busy, with sufficient orders at hand to keep fully engaged for months. Demand in some other lines, however, has slackened. Westinghouse's backlog today stands at about $80,000,000.



Allies To Get Latest Type U. S. Planes

French and British will take planes originally intended for Army, thus building up big aircraft industry here at foreign expense. Plan keeps the Allies from looking to other sources.

WASHINGTON—Announcement that in selling aircraft to the Allies this country is going to make a lot more concessions than were originally admitted occasions little surprise among insiders. Release of every model that has reached production stage and sidetracking of some U.S. orders to speed production for the Allies are logical outgrowths of a definite though complex policy that has been taking shape since late last fall.

Most of the dramatics, as Congress and the public were let in on the plans, were stage-managed. Even while it was being announced that the five or six newest models were not going to be sold, manufacturers had had the tip-off to go ahead on the basis that they could take the orders. And although the Allied three-type plan—to concentrate orders on three big suppliers and spread the work by subcontracting—appears to be in the discard, some elements in the industry still look for its reappearance.

Preparation of sentiment for the present liberalization of the rules began last month when administration sources made it their business to talk up the strength of the Germans—and the needs of the Allies. One highly authoritative source let slip, "off the record," that Germany would soon be building 6,000 planes a month, while Britain could only make 1,200 and France 400. (An equally good authority, incidentally, thinks the Germans will be doing mighty well if they turn out 2,000 a month.)

Nevertheless, the policy thus histrionically revealed does make sense. It is Roosevelt's own policy, but his partiality toward the Allies has not over-balanced a hard-headed determination to turn the war situation to our advantage. Three objectives underlie present moves:

1. Help the Allies win the war by sending them enough planes to overtop the Germans—maybe 2,000 to 3,000 a month by next year. And in the process—

2. Make the Allies pay for the creation in this country of the biggest aircraft plant in the world. But, while doing so—

3. Maintain the superiority of our own air force by releasing only enough of our most advanced models to prevent the Allies from being outclassed by the Germans, and to keep the Allies from looking to other sources—Italy or Canada—for airplanes. The

JAPS WANT PRECISION TOOLS

TOKYO—An association of 132 members is now actively in charge of importation of cutting and measuring tools, a shortage of which exists in Japan. S. Noda, president of Roku-Roku Shoten, Ltd., is chairman of the board of directors. The Government is reported eager to encourage inflow of cutting and measuring tools of high quality for the precision industries. Hence, the Association is more than willing for U. S. manufacturers of these products to cultivate the Japanese market.

Farm Equipment Makers Expect Good Year as Farm Income Rises

CHICAGO—Government bounty for the farmer peaked in January of this year (instead of March as in 1939) to help give a total cash income for the first two months of 1940 of $1,378,000,000. This was higher than the same period last year by $218,000,000, only $90,000,000 of which was due to improved markets, the rest being due to more government payments.

Probabilities are that farm income will not hold up to this high level, as government subsidies will taper off from its early peak and no radical change in the market situation can be anticipated. Unless effects of war cause a big change, the best guess for 1940 farm income is about $9,000,000,000, or $500,000,000 better than last year. On this basis farm equipment manufacturers can anticipate domestic sales of about $450,000,000 in 1940.

In addition to the high income figure for the first two months of the year, other favorable straws include good sales and inquiries since October and good continued interest on the part of prospects in dealer showings. International Harvester has had good sales in this period; Oliver Farm Equipment had a better year last year than in 1939 with the improvement continuing in the first two months of this year. Allis-Chalmers has been going along at a good rate building up a stock of its small tractor, and dealer stocks are in better shape than they were a year ago when the company was having strikes.

Fast and Furious—*Guns of the world's most heavily armored pursuit ship can be serviced in ten minutes instead of the several hours required by other planes. Barrel and internal mechanism of each gun can be removed without disturbing the gun in its mounting. The 400-m.p.h. ship, the Vultee "Vanguard," mounts eight 30-caliber guns firing about 4,000 rounds of ammunition and two 50-caliber guns firing 500 rounds. Three 30-caliber guns are mounted in each wing, the other two and the two 50's firing through the propeller*

Tricks of the Trade—*These Canadian Royal Air Force recruits are being initiated into mysteries of a machine gun. Class is at an Ontario air base*

administration is especially impressed by the last point. At all costs the British must be discouraged from building up a competing productive plant in Canada. And although Italy now produces only about 250 ships a month, the capacity is there for perhaps 1,000 if Britain would let her have the material.

The manufacturers themselves are gleefully looking after Point 2 under the benevolent eye of Washington. They are collecting cash down, not only for planes, but also for every new factory or factory extension.

What Price Production

The first point—pushing production up to where it will give the Allies some real help—is getting the personal attention of Secretary of the Treasury Morgenthau. He is making sure that tax policy puts no obstacles on plant expansion and is using his influence to smooth out internal difficulties of the aircraft industry. Prime example of this is the machine tool priority agreement intended to clear up the engine bottleneck.

Although the problem is not yet solved, some real success is claimed. Factory space devoted to plane engines has increased since the start of the war from 2,000,000 to 3,000,000 sq. ft., and engine production is up from 600 a month to about 1,100. This last is due to rise sharply when Allison's new plant gets rolling. It's still a problem, though, since airplane production is now about 1,400 a month and lots of them pack more than one engine.

These ambitions plans may not, however, result in quite such an ungodly pressure on the tool people as you might assume. There are indications that, for a time at least, the Allies will take some of the heat off delivery schedules. So long as all is quiet on the western front, the same fact influences the foreigners that led the Army to yield some of its priorities. Every time you defer this week's delivery to next week you get a better plane.

So little in fact are the Allies anxious for immediate use of the ships they are buying that although they are taking delivery of close to 1,000 a month, they are shipping only about a third of this overseas. Some are being shipped as parts and assembled abroad, but most are being piled up in east and west coast warehouses. When they are wanted they can be delivered to the battlefronts by ship in one to two months. Or, if the need is great they can be flown.

None of this means that capacity is not going to be increased—and fast. In the present situation capacity is the thing. Military theoreticians figure that for an all-out air war (there's never been one yet) you've got to rebuild your whole airfleet every two months.

1940 WAR EXPORTS HIGH

WASHINGTON—Arms, ammunition and implements of war exported in January and February were valued at $43,256,450. France led with $18,878,000 followed by England with $7,615,285. Australia took $5,940,340 worth. Canada, Sweden and Turkey bought more than $1,500,000 apiece. During February, 17 arms import licenses were issued, making a total of 33 for the year 1940.

MORE SHIP AND TRUCK ORDERS FEATURE NEW CANADIAN BUYING

MONTREAL—Most important of recent government war orders is the purchase of 7,302 service trucks, lorries and tractors for the First and Second Divisions and the auxiliary forces of the Canadian Active Service Force. This order valued at over $9,000,000 is divided between General Motors of Canada and Ford Motor Company of Canada.

Shipyards Active

Two 7000-ton Canadian National passenger steamships are to be converted into armed merchant cruisers at a cost of about $1,000,000. Halifax Shipyards, subsidiary of Dominion Steel & Coal Corporation, will convert the *Prince David* at a cost of about $535,000. Burrard Drydock Company of North Vancouver has a similar contract, for conversion of the *Prince Robert*, for $600,000.

Contracts for construction of minesweepers at a cost of nearly $10,000,000 have been awarded to shipyards on the Pacific Coast. Burrard Drydock Company has two contracts for $4,017,600 each. An order of $1,350,000 has been awarded to Prince Rupert Drydock Company. Previously, the government had awarded contracts totaling $31,000,000 for anti-submarine patrol boats to shipyards in eastern Canada and on the Great Lakes.

Massey Harris Company plans to reopen its plant at Weston, Ont., which has been idle since 1922, for manufacture of parts for Avro Anson airplanes. Recently the Canadian government placed a substantial order for Avron Anson parts with the English company, and arranged for the assembly of the parts in Canada.

Ford Expands

Ford Motor Company of Canada is to spend $1,175,000 for expansion of manufacturing facilities, and other changes, at its main plant at Windsor, Ont. The program includes a new physical laboratory, new equipment in the foundry and machine shop, and miscellaneous new equipment and improvements in the plant. The foundry program totals about $240,000 and includes a new annealing furnace, improved handling systems, air conditioning and other equipment. There is to be a new overhead conveyor system to link the production lines in the foundry and the machine shop; the cost will be about $60,000. In the machine shop, $50,000 will be spent for a carburizing furnace.

Backlog of Canadian Car & Foundry Company, Ltd., has been increased by approximately $2,000,000, as result of a new contract, connected with war orders, which will utilize units of the company that have been idle for some years.

INSIDE DETROIT

C.I.O. expects victory in N.L.R.B. elections at General Motors plants. Union will sidetrack extreme demands and looks for peaceful negotiations in revising its contracts

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—"Wednesday, April 17, will be CIO day for GM workers," declares the *United Automobile Worker* (UAW-CIO organ), alluding to the date set by the National Labor Relations Board for elections affecting 125,000 workers in 59 General Motors plants. These elections are sure to prove once more that rank and file labor in the automobile industry is "union minded" and accepts the principles of industrial unionism as opposed to craft unionism. Most observers believe that the UAW-AFL cannot hope to win a majority in more than one or two of the 59 GM plants, and that a "neither" vote is more likely to prove successful where the UAW-CIO is rejected.

The extent of allegiance of automotive labor to the UAW-CIO is revealed by a "partial list" of companies with which that union has agreements. It is stated that collective bargaining contracts are held with 340 companies operating 430 plants and employing 400,000 workers. Not all of the employees are union members. But these 400,000 employees receive an average hourly wage rate of 95 cents as compared with an average of 93 cents for the entire industry.

Several weeks ago it was declared that peaceful negotiations for a revised contract will follow the NLRB elections. That view was later confirmed by a public statement issued by Walter P. Reuther, of the UAW-CIO union's GM department. He said:

"The UAW-CIO has taken all steps required under the existing agreements with GM to insure orderly negotiations for an improved agreement as soon as the elections are over."

Extreme Union Demands Sidetracked

The required 60-day notice of intention to revise the contract has been filed with the corporation, and it has been acquainted in a general way with the list of demands. Negotiations are expected to commence early in May.

These parleys will begin with an auspicious background. On the one hand, General Motors acted to facilitate the elections by: (1) refraining from legal tactics designed to put off the elections until the summer slump, and (2) offering to erect election booths upon plant property at its own expense.

The union, on the other hand, decided in its quarterly executive session to jettison controversial features of the list of demands that had been sent up earlier as a trial balloon. In particular, a top demand that the corporation embark upon a 30-hour week at 40 hours pay, and a second demand that a guaranteed annual wage be instituted, were abandoned. They were declared to be union "objectives" for the remote future, but this is viewed as a face-saving out.

Radically Different Situation

The revised list of demands includes: (1) a general wage increase; (2) vacations with pay; (3) a day-work basis of pay unless negotiated otherwise in local plants, (4) complete recognition of the shop steward system; (5) improved seniority provisions; (6) improved grievance procedure; (7) 24-hr. notice to committee men and stewards before discharge or transfer of an employee; (8) time and a half for overtime and Saturdays and double time for Sundays and holidays, also 10 cents an hour premium for night work; (9) if there is dissatisfaction after management has set time standards on an operation there shall be a joint time study and negotiations with the union before an employee is taken off the job or penalized.

There will be seemingly endless work and argument over writing a new contract with these and other provisions, but there is nothing in the revised set of demands designed to provoke a head-on collision. The situation is totally unlike that which prevailed prior to and during the Chrysler slowdown strike last fall. That fiasco appears to have driven extreme radicals out of union councils.

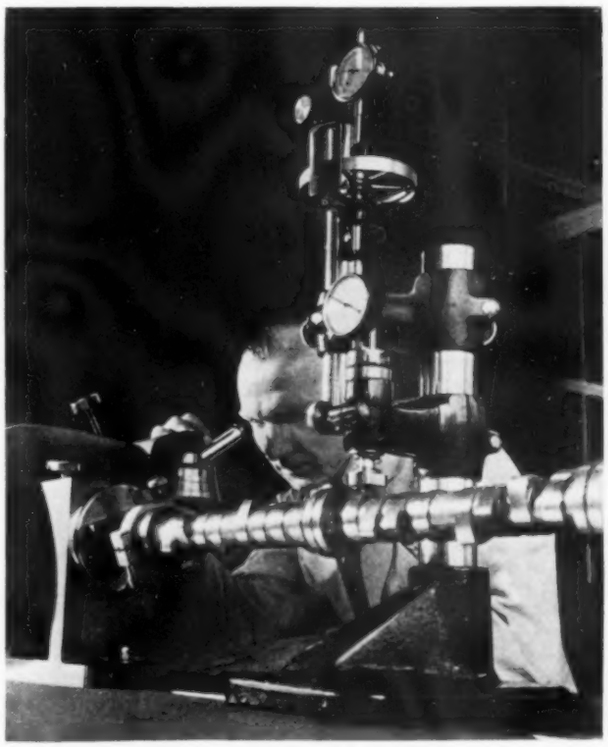
A lot of water has gone over the

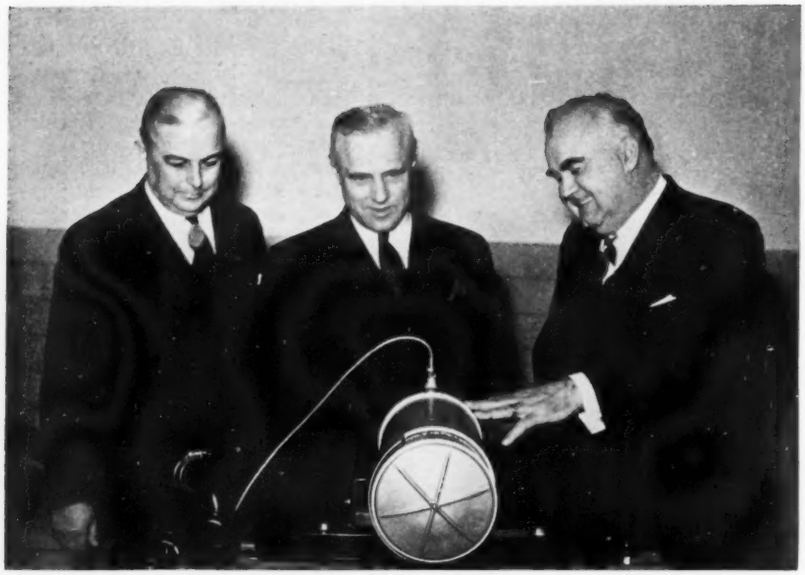
GRAHAM STARTS ON NEW MODELS

DETROIT—Within a few weeks about 2,500 men will be on the job turning out 100 "Hollywoods" daily, according to President Joseph B. Graham, Graham-Paige Motors Corp. Several hundred men were summoned to work last week to supplement the 150 key men who have been conducting "pilot tests" on new machinery and fixtures. Start of subassemblies for the Hollywood models were started late last month, with final assemblies to begin this week. The Hollywood will be available in two body styles, and is in addition to the established Graham "Seniors."

Close

This testing set-up is claimed to enable Cadillac-LaSalle inspectors to measure cam contours to within one fifty thousandth of an inch. Through a microscope which magnifies 40 times, the operator first establishes a point on the shaft, then reads from the dials at the right the rise and fall of the cam over fractional degrees of a revolution





First motor *to be tested in Chrysler Corporation's new dynamometer building is caressed by F. M. Zeder, right, head of engineering. Looking on are Carl Breer, left, director of research, and Dr. Karl M. Compton, president Massachusetts Institute of Technology, who flipped the switch starting the first piece of testing apparatus. Begun last August and to be finished in May, the engine testing and research laboratory will be the most modern in the world*

dam since the GM tool and die strike last summer and the Chrysler strike. Top executives on both sides of the bargaining table sincerely want peace and have attained mutual respect through months of satisfactory relationships. For one thing management can be reasonably certain that the union will live up to an agreement, something which was impossible to predict until the UAW-CIO faction became the undisputed bargaining agency of a majority of auto workers. Since that time sincere efforts have been made on both sides to make collective bargaining work. When it comes to negotiating, each side knows how far the other can go within reason, without giving away an essential right or prerogative.

It is impossible to predict how much of a wage increase will be given General Motors workers. Naturally the union will try to get all it can. There will be much talk about the $183,000,000 GM profit in 1939, the high salaries of executives, and the dividends paid to stockholders who have done nothing except "own pieces of paper." Yet the union knows that any drastic wage increase would be passed on to consumers and react to their own detriment in the long run.

Consumer Angle Played Up

General Motors stressed the consumer angle in a timely pre-election distribution of its second annual report to employees last week. For example: "What Mr. G. M. Customer's increased activities meant in terms of more wages in U. S. plants last year is illustrated by the figures shown above (G.M. paid $74,900,000 more wages)." The report states that average annual earnings for regularly employed hourly wage employees were $1,503 in 1939. The average GM hourly rate for all U.S. plants that year was 44 per cent above the average for all manufacturing industries. The increase in weekly hours averaged 12 per cent. Employment of hourly workers gained 24 per cent as compared with an average employment increase of 10 per cent for all manufacturing plants in the country.

The annual report to employees also showed what better tools mean to customer and worker. The report says: "Equipment permitted to become worn out, tools that are obsolete, and inadequate facilities for carrying on manufacturing operations can be a greater danger to the business than any other single factor." Expenditures for the six years ending with 1939 are cited as $290,400,000 for plant construction and new equipment and $183,000,000 for special tools for yearly product improvement.

Packard Again in the Black

Packard's annual report reveals that 369,306 cars were produced in the five-year period ending in 1938, or approximately half the total built in the company's 40 years of existence as a motor-car manufacturer. Operations were profitable in four of these five years, during which an expansion program was under way for a dual purpose: (1) reducing manufacturing costs to permit lower prices, and (2) increasing capacity three-fold without adding factory buildings. After incurring a deficit in 1938, the company returned to the profit column by reporting income of $545,867 for 1939.

Chrysler Modernizes

Chrysler has begun construction of a 135 x 575-ft. building at its Highland Park plant to replace two older structures. Unit will be completed in June and will be used for parts manufacture.

GOOD SECOND QUARTER IN SIGHT

DETROIT — Appreciable sales gains in the second ten-day selling period of March are attributed by automobile makers to strong underlying business conditions. Certain manufacturers had previously established April production schedules 10 per cent ahead of March, and these new sales gains may cause some further revision upwards. Assemblies for the second quarter appear headed toward 1,400,000–1,450,000 units.

For the second ten-day period of March, sales of Ford and Mercury cars were 31 per cent ahead of last year. Buick gained 66 per cent; Olds' 49 per cent.

U. S. Government Contracts Awarded to Tool Makers

(Other Metal-Working Contracts on Page 220j)

Contractor	Gov't Agency	Commodity	Amount
Kraeuter & Co., Newark, N. J.	Navy	Pliers	$20,963
Nicholson File Co., Philadelphia, Pa.	Navy	Files, rasps	38,755
Delta File Works, Carver File Co., Philadelphia, Pa.	Navy	Files	22,829
Alliance Machine Co., Alliance, Ohio	Ordnance	Drop hammer	28,188
Jones & Lamson Machine Co., Springfield, Vt.	Ordnance	Lathes	43,716
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio	Ordnance, Navy	Milling machines	63,505
Monarch Machine Tool Co., Sidney, Ohio	Air Corps	Precision lathes	27,574
National Automatic Tool Co., Richmond, Ind.	Navy	Drilling machine	12,951
King Machine Tool Co., Cincinnati, Ohio	Navy	Turret lathe	10,675
National Twist Drill & Tool Co., Detroit, Mich.	Navy	Twist drills	97,666
Gisholt Machine Co., Madison, Wis.	Navy	Turret lathes	10,275
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy	Engine lathes	33,202
Acme Machine Tool Co., Cincinnati, Ohio	Navy	Lathes	17,711
Gould & Eberhardt, Newark, N. J.	Ordnance	Gear-cutting machine	10,400
Machine Tool & Die Co., Detroit, Mich.	Ordnance	Presses	18,080

Only 56 Items Covered by Educational Orders

WASHINGTON—Congress will decide soon how much money to put up for the third year of the War Department's educational orders for munitions. The Department figures that about 1,200 items and processes will present particularly difficult procurement problems in case of a war. About half of these items are distinctly military, the other half are very similar to commercial products. Also, the Department counts about 2,000 commercial manufacturers who have not had war orders, but which are so equipped, financed, and experienced that with adequate "education" they could be booked to start turning out the 600 military items on short notice in emergency.

But for the present, the government is contenting itself with a program of 56 really critical items. Up to March 15, about 32 of these items had been ordered and about 24 items remained unordered. It took 705 invitations to get enough suitable bids on the 32 items. The accompanying table shows that a total of 67 orders have been awarded from 1940 funds, plus six orders from 1939 funds. If Congress actually appropriates for the fiscal year 1941 the money ($18,250,000) previously authorized it is probable that more than the 24 remaining items will be covered by orders and that the critical list of 56 will be extended. The War Department is hopeful but is not counting its chicks before they're hatched because Congress in its present mood is very likely to cut down on the cash.

About half of this year's $14,250,000 has been spent or obligated. The balance will be obligated long before July 1. Orders have gone to about 70 per cent of the plants in which this year's program will be executed. Two firms, thus far, have received sizeable regular contracts as follow-ups on educational orders: Winchester Repeating Arms for semi-automatic rifles, and General Electric for searchlights. But many firms who get educational orders will never get regular orders unless an emergency boils up.

Educational Order Awards to Date for Fiscal 1940

Aircraft parachute flares	Kilgore Mfg. Co., Tippecanoe City, Ohio	$13,331.50
	National Fireworks, Inc., Boston, Mass	13,431.00
Fuzes, bomb	Grayson Heat Control, Ltd., Lynwood, Calif	98,092.43
	Chrysler Corp., Detroit, Mich	97,079.03
	Corbin Screw Corp., New Britain, Conn	29,340.60
Howitzer, 75-mm pack	C. H. Cowdrey Machine Works, Fitchburg, Mass	174,208.50
Forgings, 81-mm shell	Dresser Mfg. Co., Bradford, Pa	3,993.30
Signals, ground, parachute	Essex Specialty Co., Berkley Heights, N. J	6,791.93
	Unexcelled Mfg. Co., Reading, Ohio	8,241.25
	Triumph Explosives, Inc., Elkton, Md	5,660.00
	M. Backes' Sons, Inc., Wallingford, Conn	8,056.10
Bomb, 500-lb., metal components	Consolidated Steel Corp., Los Angeles, Calif	109,626.00
Bomb, 1,000-lb., metal components	American Car & Foundry Co., Berwick, Pa	81,167.00
Booster, metal components	Electric Household Utilities Corp., Chicago, Ill	42,656.67
	National Pneumatic Co., Rahway, N. J	62,745.63
	Wright Machine Co., Worcester, Mass	74,238.00
	Federal Screw Works, Detroit, Mich	59,795.28
	Sunbeam Electric Mfg. Co., Evansville, Ind	77,799.28
	Warren Webster & Co., Camden, N. J	34,551.37
Fuze, point detonating, metal components	National Cash Register Co., Dayton, Ohio	70,132.99
	Fulton Sylphon Co., Knoxville, Tenn	101,991.00
	Federal Screw Works, Detroit, Mich	72,040.85
	Philadelphia Storage Battery Co., Philadelphia, Pa	133,485.64
Range quadrants, light artillery	Cummings Machine Works, Boston, Mass	51,587.50
Pistols, 45 automatic	Harrington & Richardson Arms Co., Worcester, Mass	192,497.50
	Singer Manufacturing Co., Elizabeth, N. J	278,875.67
Machining 75-mm. shells	Armstrong Cork Co., Lancaster, Pa	85,165.11
	J. B. Beaird Corp., Shreveport, La	108,770.35
	Continental Gin Co., Birmingham, Ala	72,521.40
	Chrysler Corp., Detroit, Mich	110,616.50
	Darling Valve & Mfg. Co., Williamsport, Pa	58,902.63
	General Railway Signal Co., Rochester, N. Y	102,560.28
	Kingston Products Corp., Kokomo, Ind	44,372.70
	Murray Co., Atlanta, Ga	91,206.35
	New York Air Brake Co., New York, N. Y	79,552.31
	Robbins & Myers, Inc., Springfield, Ohio	85,170.00
	Stockham Pipe Fittings Co., Birmingham, Ala	69,957.62
	U. S. Machine Corp., Lebanon, Ind	38,055.83
	Wheland Co., Chattanooga, Tenn	66,758.67
	Chevrolet Motor Div., G.M.C., Detroit, Mich	100,850.00
Forgings, 75-mm. shells	Chrysler Corp., Detroit, Mich	67,732.00
	Pressed Steel Car Co., Pittsburgh, Pa	119,832.00
	Tennessee Coal, Iron & R.R. Co., Birmingham, Ala	130,350.50
	Pittsburgh Forgings Co., Coraopolis, Pa	36,364.88
	Chevrolet Motor Div., G.M.C., Detroit, Mich	36,127.20
Forgings, 155-mm. shells	Colorado Fuel & Iron Co., Denver, Colo	251,674.25
	Taylor-Wharton Iron & Steel Co., Easton, Pa	209,217.25
Machining 155-mm. shells	Koy Company, East St. Louis, Ill	164,205.30
	Minneapolis-Moline Power Implement Co., Minneapolis, Minn	139,628.60
	Omaha Steel Works, Omaha, Neb	161,658.00
Centrifugal castings	Duraloy Co., Scottsdale, Pa	148,920.00
Telescopes, antitank gun	Eastman Kodak Co., Rochester, N. Y	34,566.01
Cartridge cases, 75-mm. gun	Chrysler Corp., Detroit, Mich	154,082.40
Machining 81-mm. shells	W. C. Norris Manufacturer, Inc., Tulsa, Okla	76,689.59
Telescope mounts	Precision Mfg. Co., Philadelphia, Pa	71,220.00
	Builders Iron Foundry, Providence, R. I	105,509.94
Fuzes, time and superquick	Scoville Mfg. Co., Waterbury, Conn	153,152.00
Telescope, panoramic	Mergenthaler Linotype Co., Brooklyn, N. Y	99,245.03
Gas masks	Firestone Tire & Rubber Co., Fall River, Mass	328,329.00
	Johnson & Johnson, Chicago, Ill	347,714.00
Gas-mask carrier	Goodyear Tire & Rubber Co., Akron, Ohio	88,167.00
Non-coconut charcoal	Carlisle Lumber Co., Onalaska, Wash	283,990.00
Whetlerite	Carlisle Lumber Co., Onalaska, Wash	61,627.50
Telephone, field	Kellogg Switchboard & Supply Co., Chicago, Ill	36,938.27
	Holtzer-Cabot Electric Co., Boston, Mass	43,482.63
	Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y	48,984.88

AGREE ON WAGE-HOUR CHANGES

WASHINGTON — Prospect of amending the Walsh-Healy law this session is teetering in the balance. Chances seemed small so long as only CIO favored the change. But now AFL also favors it, and action might possibly be taken. Administration proponents are passing the word around that labor will need the benefits of the Wagner Act amendments. Hearings on the amendments have been completed by the house judiciary committee, and executive sessions are expected in a few days. One of the amendments, as now drafted, would enforce "going wages" on government contracts as low as $4,000, whereas the present minimum is $10,000. Another would withhold contracts from firms found by the courts to have violated NLRB.

ARMY ASKS BIDS ON BIG GIROS

WASHINGTON—On April 22 the Air Corps will receive bids on rotary-wing aircraft. It is expected that Pitcairn Autogiro Co. and Kellett Autogiro Corp. will submit machines. Kellett will offer a 4000-lb., five or six passenger cabin ship, with a Pratt & Whitney 425-hp. engine. One of the problems now, in building bigger giro, is finding a manufacturer who has time to design the rear drive and clutch assembly which speeds up the rotor for take-off.

In the helicopter field, Platt-Le Page and possibly Helicopter Corp. are expected to offer equipment. These will be advances on progress made by the Germans. In both giro and helio lines, the Air Corps will consider designs on paper if submitted by persons of known ability. Undoubtedly the lunatic fringe will be there.

The rotary-wing program, approved in 1938 by Congress, authorizes the Post Office, Agriculture, Commerce, Interior, War and Navy and other federal agencies to call for machines with certain characteristics suited to their needs, and to advise in continued experiment. To date, only the Air Corps and the Post Office have shown active interest.

WATCHING WASHINGTON

T.N.E.C. probe may show high machine output benefits labor by increasing wages and lowering prices. Machine-tax bill lacks support—labor opposes this brake on production

McGRAW-HILL WASHINGTON BUREAU: PAUL WOOTON, CHIEF

WASHINGTON — Machine builders have been praised so often as labor-savers and damned so often as labor-displacers that one more investigation may sound pretty dull. But T. J. Kreps and H. Dewey Anderson, Stanford profs masterminding the TNEC probe of technology, will try to produce a study more serious and going deeper than did the Technocrats or the National Resources Committee. Anyway they have an all-star cast lined up. Technology they take as being any technique of management, trade or finance—as well as production—which increases the output of labor. They will try to show that when the benefits are passed on in higher wages or lower prices the nation's wealth is greatly increased. Failure to pass on the benefits, conversely, results in concentration of economic power and industrial stagnation.

Fields covered will include auto, steel, coal, textiles, railroads and construction, in each case with a spokesman for the industry and labor.

Some fear was felt at first that TNEC Chairman O'Mahoney's machine-tax proposal might arouse the hostility of witnesses, but it has dropped out of sight so fast that this has been pretty well dissipated. The bill isn't even sure of much labor support. Although it was sponsored by the AFL electricians, the federation itself and the CIO are both refusing to commit themselves; and CIO braintrusters assert privately their opposition to any such attempt to put a brake on production.

Is This A Protest Against NLRB Board?

Confirmation by the House of the Labor Committee's cut in NLRB fund, $337,000 below budget estimate, is accepted here as official protest against the conduct of the Board. Key Democrats have informed President Roosevelt that for political help if for no other reason the administration had better compromise and permit some kind of modification in favor of business. Consequently the Labor Committee, though it is determined to uphold the law and the principles of collective bargaining, is now willing that administrative changes should be made. The Committee is against abolition of the Board and appointment of a new one, but it does say that two more members might be added making it a five-man authority. Other changes were being hotly debated as this was written. The probability that the law will be amended and the Board changed have greatly increased contrary to expectations here.

Big War-Material Procurements Unlikely

Procurement of strategic materials is going ahead slowly. Congress last year authorized the Army and Navy to spend $25,000,000 but appropriated only $10,000,000, and added only $3,000,000 this year. Meanwhie, Senator Townsend (Rep. Delaware) proposes that $500,000,000 of the gold stabilization fund be used to purchase the materials. A report on the proposal is awaited from the Treasury Department, while the Senate Banking and Currency Committee is inactive in the matter. War and Navy would like to have the money, from any source, but they wouldn't spend it. Prices are too high, due to the war. Congress likes to hold the purse strings, which are attached to votes, and will not give War and Navy *carte blanche*. A big procurement program seems unlikely.

Wage-Hour Hearings May Be Curtailed

Members of House Labor Committee are growing impatient about Wage-Hour Administrator Col. Philip Fleming's delay in modifying and clarifying his interpretation of the law. He agreed to do this if proposed amendments were withheld. Unless some early action is taken by him, the statute might still be revised this session. Of interest to metal-working men is a suggested change that would exempt executive and professional workers from the hours control provisions. A number of trade associations have petitioned Fleming for redefinition of such jobs; a hearing will be held April 10; Fleming's action will show how the wind is blowing. Meanwhile, House Appropriations Committee has recommended cutting Wage-Hour funds for 1941 by $1,080,000 to $6,185,000.

BIDS RECEIVED ON 24 TANKERS

WASHINGTON—Maritime Commission received bids on 24 super-tankers being built jointly by oil companies and the Commission. Sun Shipbuilding and Drydock was lowest with $2,600,000 for each ship—$470,000 apiece more than was paid for the first twelve. The tankers operate at 16½ knots, have gun bases, and are stiffened to withstand gun fire. Standard Oil of New Jersey is taking 12 of the ships. Six go to Socony Vacuum. Who will get the remaining six is not yet known.

Huge Bomber Not for Allies

War Department announces that Douglas is building for it a 70-ton four-engined all-metal bomber, the largest airplane in the world, for delivery some time this year. It is more than twice as big as the "flying fortress" which weighs 30 tons. The plane will be flight tested some time next summer. Among its features are 16-foot three-bladed propellers, and a three-wheeled undercarriage. Cost of the initial plane will be near $1,000,000 but production units would cost about $350,000 each. The greatest secrecy is being maintained, but officials admit that reports it would fly to Europe with 28 tons of bombs and return are exaggerated. A round-trip attack between here and Europe is not yet in the realm of possibility. Actually, the ship is designed for operations in the Western hemisphere. There is no intention of selling it to the Allies; they have no need of long range bombardment; are concentrating on light and medium bombing equipment.

New Anti-Aircraft Guns Prove Effective

The fine art of military murder and destruction is undergoing the greatest overhauling in history. The "civilized" world is waiting to see whether improved aircraft and bombing technique can obsolete naval warfare. On land all the skill of ordnance men is concentrated on defense against the overhead menace. The Army has tested a new 90-mm anti-aircraft gun and expects the 1941 War appropriations to carry funds for construction of about 100 units. This gun will supplant to some extent the three-inch battery. Its projectile will go higher, will be effective in a greater space when it explodes, and will have a higher velocity, which will simplify the gunner's accuracy problem.

GAGES FOR WAR PRODUCTS UNDERGO SEVERE INSPECTION

OTTAWA—Born of the war and destined to die with the return of peace, a gage-inspection service has been established by the National Research Council of Canada to help Canadian manufacturers, especially those holding contracts for munitions of war.

A rigid test by Government inspectors is made of the manufacturers' finished products, which must conform to the specifications of the Dominion War Supply Board. Inaccurate gages will pass products that should be rejected, or reject parts actually within the tolerances—so that means for controlling the gages themselves become very important.

The new laboratory has been equipped to carry out this work—really inspecting the gages—which in turn are used to inspect the shop products. As these products must in many cases be correct to one thousandth of an inch, the gages controlling them must be measured to a ten-thousandth.

Again, what are known as "block" or "slip" gages are used in toolrooms and laboratories to verify the gages just mentioned and, still to attain the desired precision, a precision expressed in one-hundred thousandths or even millionths of an inch is necessary for these "masters."

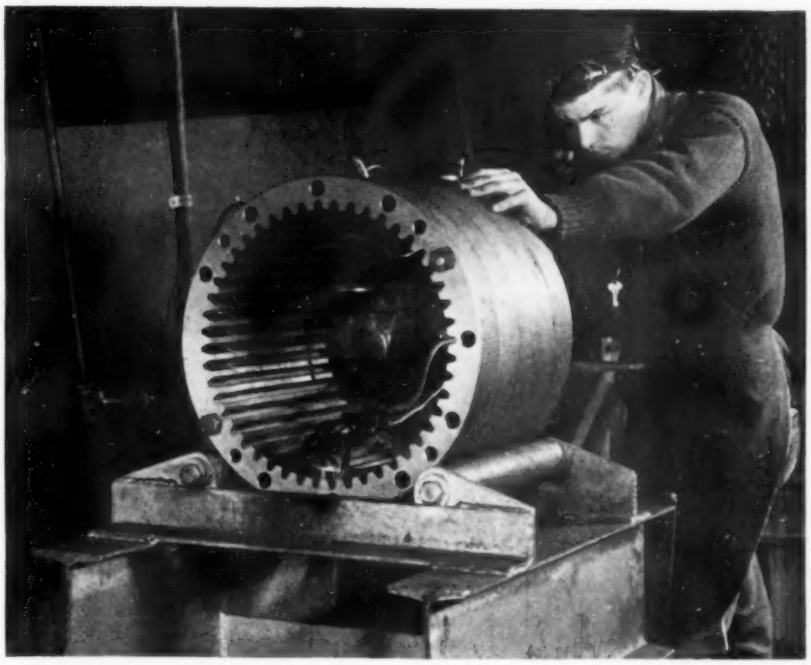
These block gages are verified in the metrological laboratory of the National Research Council, where the measurements are made optically. The standard in the optical method is the light wave-length associated with certain definite spectrum lines.

The operation is simple. The standard block gage is placed parallel to the one to be certified on a round piece of quartz. A second, smoothly polished piece of quartz of equal size to the first then is placed on top of the gages and a light ray turned on. From the appearance of the alternate bright and dark lines which are then produced it is possible to calculate the difference in length between the two gages.

POWDER METALLURGY TO STUDY

HOBOKEN, N. J.—A modern laboratory of powder metallurgy where scientists will try to open new frontiers for industry has been opened here by the Graduate School of the Stevens Institute of Technology.

Installed with the cooperation of several large American industrial organizations who are actually using powder metallurgy processes for many mechanical devices, the new laboratory will serve as a training ground to provide industry with competent researchers in this field. It will also serve as a clearing house to which industries can bring their research and development problems in powder metallurgy.



No Warpage—*Cleveland Tractor now flame-hardens SAE 4150 ring gears after machining without distortion. Former method involved carburizing, hardening and drawing, the warped gear being drilled and reamed and then ground on both faces to secure necessary alignment. Teeth remained partially inaccurate*

Latest U. S. Screw-Thread Standards Are Not Revised

WASHINGTON—The badly needed revision of federal screw-thread standards is underway. But the 1939 standard which the Bureau of Standards is now starting to mail out is simply a reprint of the 1933 set with no change except a new introduction and correction of typographical errors. The '33 standard has been out of print for some time, and since the old National Screw Thread Commission got lost in a political shuffle seven years ago there has been no one to sponsor a new printing. Hence, when the Interdepartmental Screw Thread Committee was formed last summer by the departments of War, Navy, and Commerce, its first job was to re-issue the old volume.

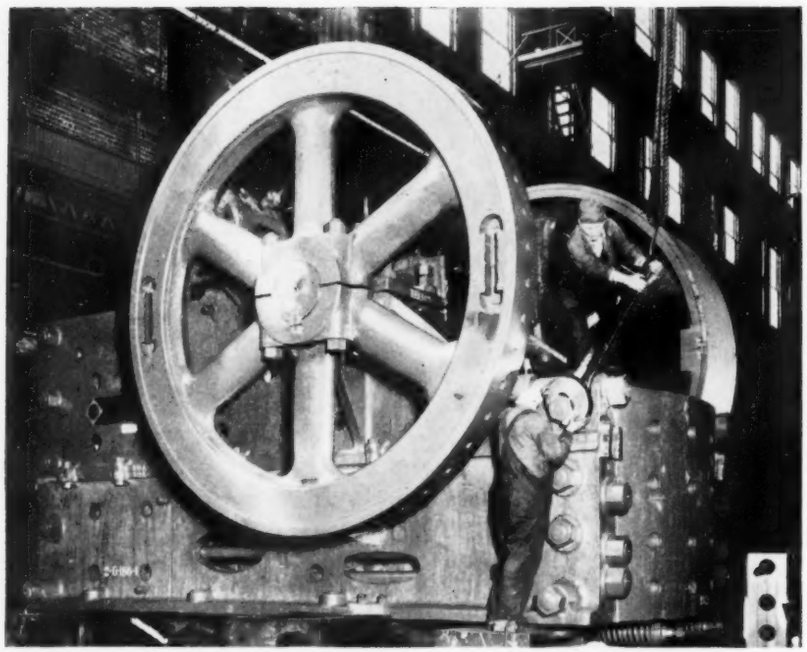
Meanwhile, however, the interdepartmental committee is meeting regularly and pushing forward a real revision of the standards—working closely with the American Standards Association and the Society for Testing Materials. A completely revised set of standards will probably come out in about a year.

Lines the revision will take are already becoming evident. There is general agreement that the standard for Acme power-transmitting threads needs extension. Then there is the problem of increasing the minor diameter of nuts. Another point at issue is specification of bolt-head sizes. This was included in the 1928 edition but omitted in 1933, and there is some feeling that it ought to be reintroduced.

Although no substantial changes are likely, the whole question of tolerances will come up for re-study. Some manufacturers think present tolerances are too severe and particularly object to requiring use of the truncated not-go gage. However, general opinion of the committee seems to be that the full-form not-go gage will pass too much bad material. Rather than relax the standards for class 2 tolerances, it is felt it would be better if screw users would specify class 1 when they can tolerate a rather loose fit.

NEW CANADIAN WAR ORDERS

ONTARIO—Latest war contracts, revealed in the Canadian government's announcements, include: Aircraft Supplies—British Air Ministry, $328,627; Irvin Air Chute, Ltd., $35,996; Canadian Vickers, Ltd., $40,088; Lockheed Aircraft Corp., $428,315; Canadian Wright, Ltd., $316,678. Machinery, tools, hardware—Caterpillar Tractor Company, $26,109; J. S. Innes, Ltd., Toronto, $31,699; Railway & Power Engineering Company, Montreal, $10,273; Canada Machinery Corp., Ltd., Montreal, $16,292; Gray Bonney Tool Co., Ltd., Ottawa, $18,792; Engineering Tool & Forgings, Ltd., St. Catherines, Ont., $11,880. Munitions—British War Office, $100,000; Dominion Engineering Company, Ltd., $128,150; Hudson Bay Mining & Smelting Co., Ltd., Winnipeg, $13 095.



Gigantic Jaws—*The first of three huge all-steel jaw crushers is now being constructed in the Milwaukee shops of the Allis-Chalmers Mfg. Company for export to the Far East. To be used for iron ore, each crusher has an opening of 84x60 in. and weighs 225 tons. The flywheel in the foreground is over 12 ft. in diameter and weighs 14 tons. The V-belt drive sheave on the other side contains 23 grooves, has a pitch diameter of 147 in., and weighs about 18 tons*

NAMES in the NEWS

ALBERT J. BERDIS has been appointed chief engineer of the Irvin works of Carnegie-Illinois Steel Corp., Pittsburgh, Pa. He succeeds EDWIN T. LORIG, who has been appointed to the staff of the chief engineer.

EDWARD P. CONNELL, treasurer of the Falk Corp., Milwaukee, Wis., has been appointed to the newly created post of general manager.

WILLIAM C. DICKERMAN, president American Locomotive Co., New York, N. Y., has been named chairman of the board. He will be succeeded by DUNCAN W. FRASER. ROBERT B. MCCOLL, vice-president in charge of the Alco Products Div., has been appointed vice-president in charge of manufacturing, the position formerly held by Mr. Fraser; and NOAH A. STANCLIFFE, general counsel, has been elected a director.

LOUIS C. EDGAR has been appointed assistant chief engineer of Carnegie-Illinois Steel Corp., Pittsburgh, Pa. ARTHUR V. WIEBEL will succeed him as chief engineer of the Pittsburgh district.

JOHN C. GEBHART has been appointed director of research, National Association of Manufacturers, New York, N. Y. Formerly executive director of the National Economy League, Mr. Gebhart succeeds MAJOR HENRY H. CURRAN, now on the magistrates' bench.

JOHN E. HARRIS, for the past five years assistant superintendent at the Chicago tractor works of International Harvester Co., has been named superintendent of the company's works in Milwaukee, Wis. He succeeds E. LEISER, retired.

COL. LEONARD S. HORNER, Hartford, Conn., consulting engineer, has been named chairman of the National Academy of Sciences committee to study the aircraft industry for the War Department.

C. N. KIRKPATRICK, former secretary and vice-president in charge of sales, Landis Machine Co., Waynesboro, Pa., has been elected vice-president and general manager. J. H. ELLIOTT, purchasing agent, has been elected secretary to succeed Mr. Kirkpatrick, and will continue as purchasing agent.

DWIGHT L. MOODY, general manager Indian Motorcycle Co., Springfield, Mass., has been appointed vice-president and a director. He fills the vacancies caused by the death of LORING F. HOSLEY.

U. S. Government Contracts Awarded to Metal-Working Firms

(Tool Contracts on Page 220f)

Contractor	Gov't Agency	Commodity	Amount
Doehler Die Casting Co., Pottstown, Pa.	Ordnance	Die castings	$24,150
International Nickel Co., New York, N. Y.	Navy	Cylinder forgings	45,200
American Bridge Co., Gary, Ind.	Interior	Tracks, gate frames	34,911
Hadley Special Tool Co., Boston, Mass.	Ordnance	Machine-gun parts	81,054
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.	Navy	Brass nuts	27,200
Guiberson Diesel Engine Co., Dallas, Tex.	Ordnance	Diesel engines	592,187
Harnischfeger Corp., Milwaukee, Wis.	Navy	Bridge cranes	83,105
Orton Crane & Shovel Co., Chicago, Ill.	Navy	Locomotive cranes	289,850
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.	Navy	Wall cranes	36,200
Wilcox Rich Div., Eaton Mfg. Co., Detroit, Mich.	Navy	Seats, valves	28,946
Worthington Pump & Machinery Corp., Harrison, N. J.	Navy	Generator	40,806
Elliott Co., Ridgway, Pa.	Navy	Generator set	28,343
Homelite Corp., Port Chester, N. Y.	Air Corps	Power plant assemblies	29,050
Electric Products Co., Cleveland, Ohio	Navy	Welders	27,540
Wolfe & Mann Mfg. Co., Baltimore, Md.	Air Corps	Switchboards	27,095
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.	Navy, QMC	Electrical equipment	55,398
General Electric Co., Schenectady, N. Y.	Navy, TVA	Electrical equipment	464,897
Ideal Electric & Mfg. Co., Mansfield, Ohio	Navy	Generator sets	96,822
Bendix Aviation Corp., Scintilla Magneto Div., Sidney, N. Y.	Air Corps	Magneto assemblies	39,135
United Aircraft Corp., Pratt & Whitney Aircraft Div., East Hartford, Conn.	Navy	Aircraft engines	7,952,766
Longines Wittnauer Watch Co., New York, N. Y.	Air Corps	Navigation watches	48,119
General Time Instruments Corp., Thomaston, Conn.	Navy	Desk clocks	30,200
James Cunningham Son & Co., Rochester, N. Y.	Ordnance	Carriage assemblies	62,856
York Safe & Lock Co., York, Pa.	Ordnance	Cradle assemblies	57,050
Lamson & Sessions Co., Cleveland, Ohio	Ordnance	Carriage bolts	25,816
American Chain & Cable Co., York, Pa.	Air Corps	Jack assemblies	28,882
Blackhawk Mfg. Co., Milwaukee, Wis.	Air Corps	Jack assemblies	36,012
Standard Pressed Steel Co., Jenkintown, Pa.	Ordnance	Eyebolts	26,640
Scovill Mfg. Co., Waterbury, Conn.	Ordnance	Fuse sockets	13,785
Baldwin-Southwark Corp., Eddystone, Pa.	Interior	Turbine, governor	72,629
Hammarlund Mfg. Co., New York, N. Y.	Signal Corps	Radio receiver	83,355
Continental Electric Co., Rockford, Ill.	Air Corps	Power plants	47,631
Fate-Root-Heath Co., Plymouth, Ohio	Engineer	Locomotives	38,250
Whitcomb Locomotive Co., Rochelle, Ill.	Engineer	Locomotives	43,260
Pump Engineering Service Corp., Cleveland, Ohio	Air Corps	Pump assemblies	52,435
National Acme Co., Cleveland, Ohio	Air Corps	Wheel & brake assemblies	373,126
Midwest Aero Mfg. Corp., New Philadelphia, Ohio	Air Corps	Test stand assemblies	30,525
Bausch & Lomb Optical Co., Rochester, N. Y.	Ordnance	Instruments	59,287

JAMES Y. SCOTT, executive vice-president, Van Norman Machine Tool Co., Springfield, Mass., has been elected president.

Mr. Scott was born in Dundee, Scotland. In 1916 he entered the employ of Van Norman Machine Tool as tracer. He successively became draftsman, layout man, salesman, assistant to the president, general sales manager, executive vice-president, general manager and treasurer. He is also a director of Perkins Machine & Gear Co. of Springfield.

GEORGE A. SMITH, assistant plant manager of the Meriden, Conn., plant of the New Departure Div. of General Motors Corp., has been appointed assistant general manager of the corporation's Hydro-Matic Transmission Div. in Detroit, Mich.

J. M. STODDARD has been appointed plant superintendent, Westcott Chuck Co., Oneida, N. Y.

J. CARLTON WARD, vice-president United Aircraft Corp., East Hartford, Conn., and assistant general manager of the Pratt & Whitney Aircraft Div., has been named a member of the Engineering College Council of Cornell University.

FRANK S. WINDOLPH has been appointed president of Chambers Brothers Co., Philadelphia, Pa.

W. W. ANDERSON

J. Y. SCOTT

W. L. POND

SALES

China Airmotive Company Federal, Inc., U.S.A., exporter of aircraft and airplane accessories to China, has set up offices at 444 Madison Ave., New York City.

JAMES W. COREY, since 1932 general sales manager Reliance Electric & Engineering Co., Cleveland, Ohio, has been elected sales vice-president.

G. H. FOBIAN, since 1926 sales manager of the Oilgear Co., Milwaukee, Wis., has been elected vice-president. He will continue as sales manager.

GEORGE L. GORDON, in charge of the New York office of Lukens Steel Co., Coatesville, Pa., has been transferred to the company's main office in Coatesville. He will engage in special sales work for Lukens and its divisions, By-Products Steel Corp. and Lukenweld, Inc. J. J. REYNOLDS, for the past thirteen years sales representative in the New York office, has been appointed New York sales manager.

J. IRWIN has been appointed Chicago district manager for the Steel & Tube Div. of Timken Roller Bearing Co., Canton, Ohio.

WALLACE L. POND has been appointed director of sales and WILLIAM W. ANDERSON sales manager of Nicholson File Co., Providence, R. I. Mr. Pond has been with the company since 1895, and for many years has served as domestic sales manager. As director of sales, he will continue to head the sales organization. Mr. Anderson has been connected with the company since 1919, spending most of that time with the Canadian branch. For the past five years he has served as sales manager for the Dominion of Canada. He will assume active supervision of all sales representatives for the company.

D. S. KERR has been appointed manager of the Atlanta office of Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FRANK MURPHY has been appointed Chicago sales engineer for the Clarostat Mfg. Co., Brooklyn, N. Y., industrial electrical equipment manufacturer.

J. H. NEWMAN has been appointed manager of District No. 1 of the wiring material sales section, General Electric Co., making his headquarters in Boston, Mass., where he was formerly a district representative. He replaces E. G. HALL, who has been transferred to Los Angeles, Calif.

WALTER L. SCHNEIDER succeeds MATTHEW A. CARPENTER as sales manager of the Falk Corp., Milwaukee, Wis. He will have charge of sales of all Falk products except those covered by the Foundry Div. Mr. Carpenter, secretary, continues in a supervisory capacity over the sales, sales promotion and advertising departments.

EDGAR C. THOMAS, sales engineer for Thomas Machine Mfg. Co., Pittsburgh, Pa.,, has established an Eastern district sales office in the Commercial Trust Bldg., Philadelphia, Pa.

PLANT EXPANSION

Dow Chemical Co., Midland, Mich., has purchased 800 acres of land with about three miles of harbor frontage on the Gulf Coast at Freeport, Tex., as the initial step in a $5,000,000 plant expansion program. According to WILLARD H. DOW, president and general manager, the development will be devoted principally to the utilization of sea water as a raw source of magnesium. Contract for the entire job has been let to the Austin Co., Cleveland, which has already started construction.

Elastic Stop Nut Corp., Elizabeth, N. J., has broken ground for a new plant in Union, N. J. The plant will be used solely for the manufacture of the corporation's line of self-locking nuts. Transfer from the present location will be made about June 1. The Austin Co., Cleveland, is the general contractor.

Federal Machine & Welder Co., Warren, Ohio, is erecting an 8,000-sq.ft. engineering building addition.

Hygrade Lamp Div. of Hygrade Sylvania Corp., Salem, Mass., has leased a 69,000-sq.ft. plant in Ipswich, Mass., which will be used in the manufacture of Hygrade "Miralume" fluorescent lighting units.

Hudson & Sharp Machine Co., Green Bay, Wis., is planning the erection of a one-story 108 x 120-ft. addition.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has erected a 30,000-sq.ft. addition to its Detroit plant.

Trachte Bros. Co., Madison, Wis., manufacturer of steel buildings and sheet metal products, has purchased additional property for use in a plant expansion program.

OBITUARIES

R. E. CLINGAN

R. E. CLINGAN, Chicago district sales manager Jones & Lamson Machine Co., Springfield, Vt., died March 11 in St. Petersburg, Fla. He was 60 years of age.

At the age of nineteen Mr. Clingan became associated with the F. B. Shuster Co., New Haven, Conn., where he worked for a number of years in the manufacturing and engineering departments. In 1908 he joined the Hess-Bright Co. (now SKF) in Philadelphia and remained with that firm until 1919, when he became associated with Bock Bearing Co. of Toledo as vice-president and general manager. The following year he was made president and remained in that capacity until the company was sold to the Timken Roller Bearing Co. in 1927. He then joined Timken in an executive capacity, remaining until 1928 when he joined New Departure in Bristol, Conn., in charge of industrial sales. In 1934 he resigned this position, due to illness, but after a six-months rest joined Jones & Lamson Machine Co. as Chicago district sales manager, in which capacity he served until his death.

AUSTEN FOX BEAM, 55, treasurer and sales manager Elk Tools, Inc., New York, N. Y., died March 7.

ALEXANDER GIBSON, 41, Cleveland salesman for Brown & Sharpe Mfg. Co., Providence, R. I., died suddenly in Cincinnati, Ohio, March 20.

L. H. GLOE, 59, auditor and purchasing agent Leyse Aluminum Co., Kewaunee, Wis., cooking utensil manufacturer, died March 4 in a Milwaukee hospital.

LOYD E. SHIRLEY, 60, vice-president and general manager C. S. Bell Co., Hillsboro, Ohio, agricultural implement manufacturer, and formerly assistant superintendent Link-Belt Machinery Co., Chicago, Ill., died March 12 following a six-weeks illness.

GEORGE E. HAMMANN, 73, president and treasurer Progressive Mfg. Co., Torrington, Conn., screw and rivet maker, died March 18 in that city after two years of poor health.

DAVID C. JONES, 63, vice-president and general manager Lunkenheimer Co., Cincinnati, Ohio, valve manufacturer, died March 11 following a brief illness.

WILLIAM TOWNSEND, 67, for 30 years head of the Chicago engineering and sales offices of Connersville Blower Corp., died March 24.

GUY S. WARREN, Sr., 54, vice-president William H. Keller, Inc., Grand Haven, Mich., precision tool manufacturer, died March 24. He was formerly vice-president of A. P. Munning Co., Chicago, Ill.

MEETINGS

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual convention, Grove Park Inn, Asheville, N. C., May 20–22.

AMERICAN IRON & STEEL INSTITUTE. Forty-ninth general meeting, Hotel Waldorf-Astoria, New York, N. Y., May 23.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Spring meeting, Hotel Bancroft, Worcester, Mass., May 1–3.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 24–28.

ASSOCIATED MACHINE TOOL DEALERS OF AMERICA. Spring convention, Claridge Hotel, Atlantic City, N. J., May 13 and 14.

CHAMBER OF COMMERCE OF THE UNITED STATES. Twenty-eighth annual meeting, Washington, D. C., April 29–May 2.

INTERNATIONAL ACETYLENE ASSOCIATION. Fortieth convention, Schroeder Hotel, Milwaukee, Wis., April 10–12.

MACHINE TOOL ELECTRIFICATION FORUM, East Pittsburgh, Pa., works of Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., May 6–8.

NATIONAL METAL TRADES ASSOCIATION. Forty-second annual convention, Biltmore Hotel, New York, N. Y., May 21 and 22.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, The Greenbrier, White Sulphur Springs, W. Va., June 9–14.

Exports of Machinery During January, 1940

	January 1940	December 1939	January 1939
Electrical machinery	$9,369,254	$10,866,114	$6,719,583
Power generating machinery except automotive and electric	1,494,777	1,612,727	746,076
Construction and conveying machinery	1,637,647	2,399,993	1,479,316
Mining, well and pumping machinery	4,254,544	4,928,431	4,439,621
Power driven, metal-working machinery	12,844,084	12,821,234	6,340,620
Other metal-working machinery	655,533	477,249	332,635
Textile machinery	1,006,753	1,021,409	656,890

Exports of Metal-Working Machinery During January, 1940

Engine lathes	$1,192,423	$778,015	$505,688
Turret lathes	768,048	881,500	373,757
Other lathes	395,324	244,875	145,049
Vertical boring mills and checking machines	602,560	770,439	308,191
Thread cutting and automatic screw machines	1,048,600	801,006	225,119
Knee and column type milling machines	727,579	717,412	302,917
Other milling machines	1,054,507	1,025,706	548,960
Gear cutting machines	573,570	466,327	238,616
Vertical drilling machines	108,115	196,777	60,503
Radial drilling machines	134,494	159,802	24,927
Other drilling machines	281,806	194,583	75,683
Planers and shapers	205,524	581,974	239,147
Surface grinding machines	334,832	162,935	106,407
External cylindrical grinding machines	496,233	424,175	216,848
Internal grinding machines	713,029	340,795	277,928
Tool grinding, cutter grinding, and universal grinding machines	641,767	546,692	205,972
Other metal-grinding machines and parts	635,482	448,142	452,439
Sheet and plate metal-working machines and parts	587,096	406,952	342,085
Forging machinery and parts	413,113	671,968	313,789
Rolling-mill machinery and parts	1,429,833	1,113,354	603,402
Molding machines	20,733	.....	13,3[illegible]
Other foundry equipment and parts	60,493	102,420	54,896
Other power-driven metal-working machinery and parts	1,417,347	1,779,498	687,635
Pneumatic portable tools	186,310	126,248	109,152
Other portable and hand- or foot-operated metal-working machines and parts	172,229	129,309	121,395
Chucks for machine tools	31,591	44,659	13,953
Milling cutters, machine-operated threading dies, and taps and similar machine operated metal cutting tools	128,337	89,206	31,398
Other metal-working machine tools and parts	137,066	87,827	56,737

SHOP EQUIPMENT NEWS

Barber-Colman No. 4 Sharpening Machine Permits Automatic Regrinding of Cutters

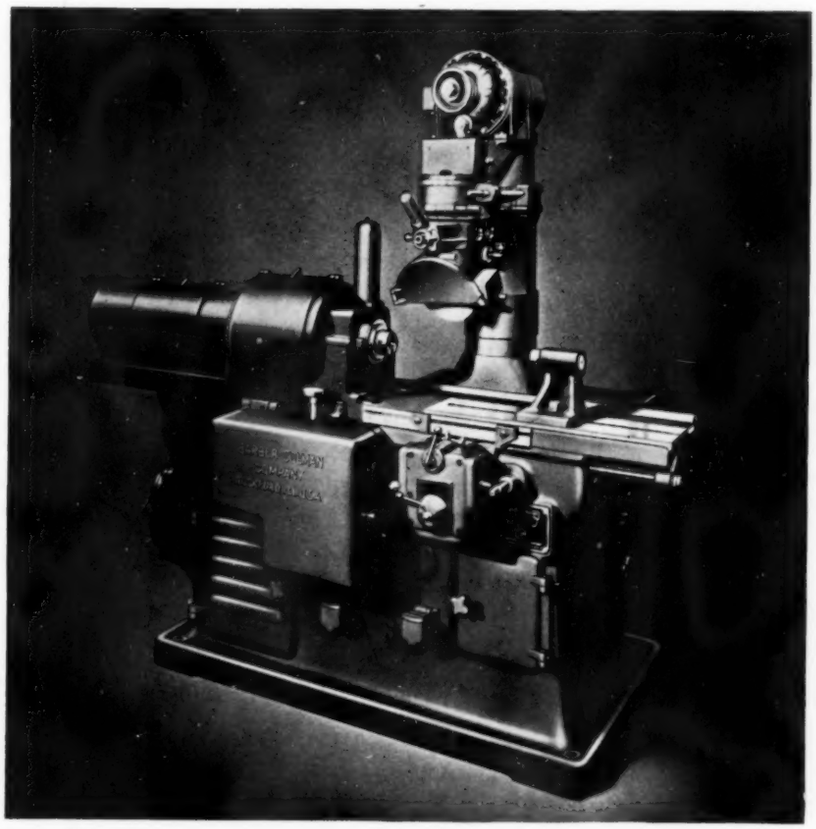
Hobs and formed milling cutters in sizes up to 10 in. diameter and 12 in. face can be automatically reground to precision limits in the improved No. 4 hob sharpening machine offered by Barber-Colman Co., Rockford, Ill. This machine features an hydraulic table drive which affords instant control of traversing speed. The spiral wheel dresser enables the operator to grind true radial faces on high-helix hobs or formed cutters. In most other respects the machine follows the design of the No. 3 automatic hob sharpening machine, except that it is, of course, larger and sturdier to take care of bigger work.

Like the No. 3 machine, this No. 4 sharpener has an upright column which supports the grinding wheel head and its individual motor drive. The motor spindle is set on an angle to bring the rear convex cutting face of the wheel in a vertical position where it meets the work. The entire wheel head can be raised or lowered to suit the size of the work, and the wheel spindle can be run back as the wheel is worn and redressed. For helical work, the wheel can be swung, about a vertical line which intersects the work center line, up to 30 deg. either side of zero. A straight-line wheel dresser is built into the wheel guard, and is used to dress the grinding face of the wheel for straight-gash and slight-spiral hobs; traversing the dresser head automatically puts a straight face on the wheel which is truly radial to the work centerline. Extra equipment includes a spiral generating wheel dresser.

The table of the machine carries the work between centers and reciprocates back and forth to pass the tooth faces across the fixed-position grinding wheel. This table also contains an automatic mechanism for indexing the work. As a part of the index mechanism there is a feed control which advances the work, after a complete circuit of indexing, so that a desired further amount of metal will be removed from the tooth faces on the next circuit. Spiral gashed hobs must, of course, be accurately rotated a part of a turn during the traversing stroke; there is an adjustable sine bar in the base of the machine which actuates a rack and pinion in the index mechanism to obtain this result.

With the reciprocating hydraulic drive used on the No. 4 machine, the length of the stroke can be controlled to suit the face of the work by means of an adjustable dog. Speed of traverse can be adjusted at any time, even while the machine is in operation. It has been found that the life of the hob between grinds can be materially increased by giving the faces of the teeth a finer finish. This is accomplished by slowing down the table speed on the last circuit of indexing. The great advantage of the adjustable table speed feature is that it permits the operator entire flexibility of control and enables him to change the table speed at any time to suit the circumstances as they occur.

The automatic index mechanism in the index drive head on the left-hand end of the table consists of a latching stop unit which engages, successively, notches in the periphery of an accurately hardened and ground index plate. A separate plate containing the proper number of notches is used for each different number of gashes in the work. As the over-and-back cycle of the table is completed, the index plate is released, then rotated by a special drive until the stop latches into the next notch, by which time the next stroke begins. There are change gears to permit alterations in speed of the rotating mechanism.



Revolving Spindle Headstock Available for B. & S. Grinders

The Brown & Sharpe Mfg. Co., Providence, R. I., has made available a revolving spindle headstock unit for Nos. 20, 22, and 23, plain grinders. This unit is designed for use when the requirements of the work call for a chuck, spring collet or driving centers, and when the full table capacity of the machine is not required and, therefore, the installation of a motor-driven, revolving spindle headstock is not warranted.

This revolving spindle headstock equipment consists of a spindle mounted on sealed pre-loaded, super-precision ball bearings carried in a sturdy casting which is clamped in

position on the table ways at the right of the headstock of the machine. The spindle is driven directly by the work driving plate of the regular headstock. Use of this unit reduces the length capacity of the machine by 14 in.

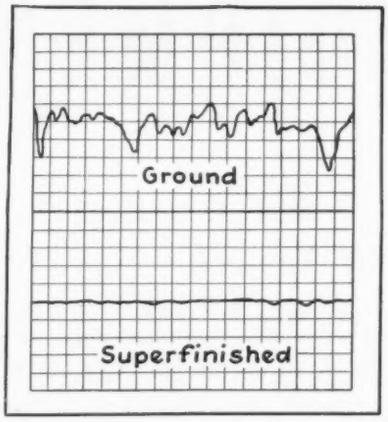
The front end of the spindle is

threaded and has a No. 11 B & S taper hole. The straight hole through the spindle is 1⅛ in. in diameter. This revolving spindle headstock equipment must be fitted to the machine at the factory. Net weight, approximately 140 lb.

Brush "Surface Analyzer" Provides Record of Finish

Designed to record irregularities in finished surfaces, the "Surface Analyzer" announced by the Brush Development Co., 3311 Perkins Ave., Cleveland, Ohio, records the amplitude as well as the number of these irregularities within a certain area, at the same time indicating whether they are above or below the bearing surface. Absolute measurements are shown without resorting to conversion formulae. Values in fractions of microinches may be determined easily.

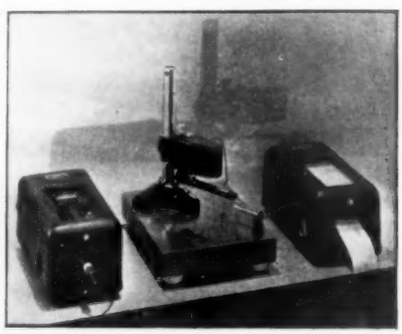
This method of recording the "topography" of a finished surface is accomplished by a finely polished



These typical charts show irregularities on ground and superfinished surfaces. Scale in each case is such that each vertical division is equal to one microinch

sapphire stylus which explores the surface to be analyzed. The irregularities in the finished surface displace the stylus which, in turn, actuates a piezo crystal element. The small voltages generated by the crystal then are magnified by an amplifier which provides sufficient voltage for operating a direct inking oscillograph. The oscillograph includes a piezo electric crystal element which converts this voltage into pen movement. These deflections, which are recorded in ink on a moving paper chart, are directly proportional to those of the stylus on the speciment surface, but magnified as much as 100,000 times.

The surface analyzer includes four separate units. These are the analyzing head, the amplifier, the direct inking oscillograph and a surface

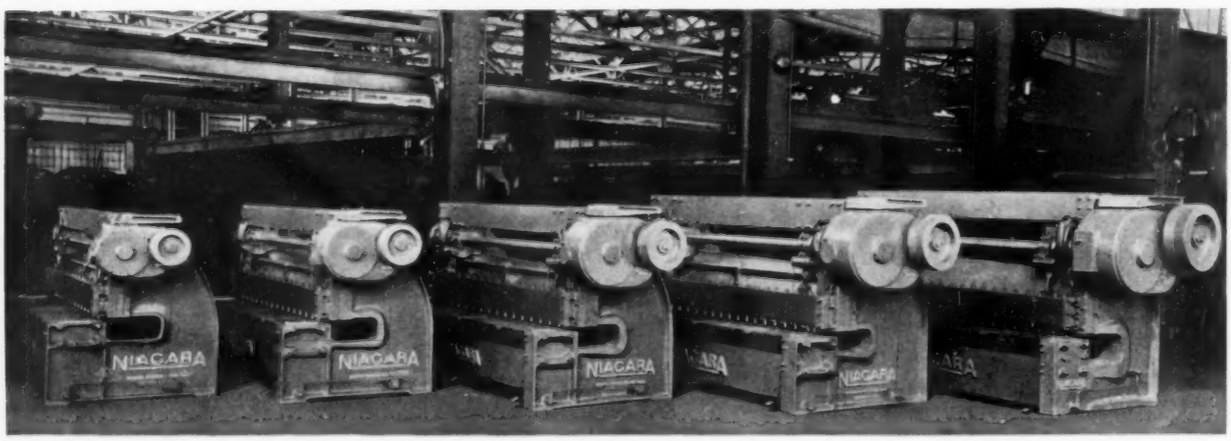


Four separate units make up the surface analyzer which records irregularities on finished surfaces. Values in fractions of microinches are determined easily

plate. Two carrying cases are furnished so that the units can be transported easily. These units may be set up in the shop or laboratory by plugging into a current supply of 110 to 120 volts, 60 cycle alternating current.

Niagara Power Squaring Shears Provide Visibility of Cutting Line

A series of power squaring shears announced by Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y., is built in sizes ranging from No. 10 gage to ½ in. capacity inclusive. Convenient arrangement of controls and gages, full visibility of the cutting line, quick acting fourteen-point engagement sleeve clutch, and high operating speeds are claimed to permit more working strokes per hour when using these shears. Each of these machines is provided with a ball bearing, self-measuring parallel back gage reading in increments of 1/128 in. Each turn of the handwheel is equal to ¼ in. of gage bar travel, and a stainless steel scale on the gage bracket indicates the position of the gage bar to the nearest ¼ in. The operating handwheel is equipped with a dial which indicates the gage position to the nearest 1/64 in. A plunger type indexing

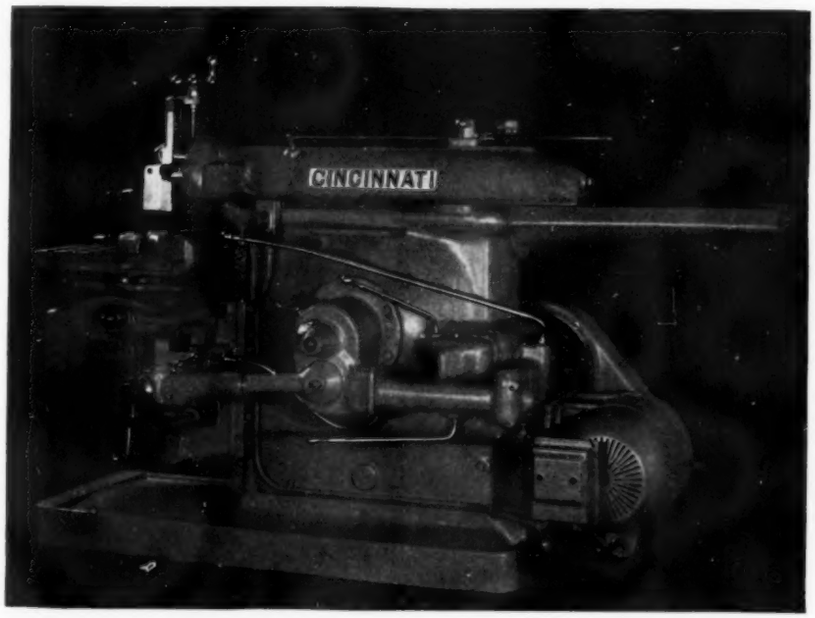


handle engages locking holes for each 1/128 in. of gage bar travel.

This gage can be rapidly adjusted for taper cutting by loosening the T-handle on the adjusting sleeve. A separate dial indicates the relative position of the gage at the right-hand bracket for non-parallel position. A truss-rod stiffens the gage bar and provides an adjustment for maintaining straightness after long usage.

Drive mechanism, including the fourteen-point sleeve clutch with built-in single stroke mechanism and all gears, are inclosed in an oil-tight case. The single stroke mechanism can be disconnected for continuous operation. A safety lock is provided to prevent engagement of the clutch when adjusting knives or gages. Gears are mounted between anti-friction bearings. Clutch and gears operate in a constant bath of oil. V-belt drive is standard equipment. Large fitted keys at each end of the bed assure permanent alignment of bed and housings. Pockets in the top of the bed save time in mounting knives. Recessed hand grooves add convenience and safety in handling sheets on the working surface of the bed. Full length T-slots for quick attachment and convenient, accurate adjustment of side, bevel and front gages simplify gage setting.

Time Saved by Relocating Controls On Cincinnati Power Rapid Traverse Shapers



Rail clamping, elevating and lowering controls now are conveniently located on the operator's side of power rapid traverse shapers manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio. An improved automatic circulating oiling system with additional reservoirs also is incorporated in these shapers. Neoprene wipers, impervious to oil, are provided for ram and rail bearings for more efficient retention of oil, and added protection of bearing surfaces. Dials and indicators are larger for easier and quicker reading.

These shapers are built in standard or universal types from 16 to 36 in. sizes. Selective multiple cam feeds located out of the way on the side of the column are used instead of ratchet feeds on these shapers. Direct reading indicators show the setting for feed, speed and length of stroke and may be read or changed while the machine is running or stopped. All may be easily read from the operating position. The main crank gear is of the helical type, made in one piece; all other gears are chrome nickel steel, head-treated. Full-length taper gibs with single screw adjustment are used for all wearing surfaces.

The unique feature of the feeding motion on these shapers is that it is actuated by a series of cams and not by an eccentric, nor by a single step cam. This gives a smooth movement and enables the entire feed under any conditions to be confined wholly within the return stroke. The eleven step cam is cut from the solid in one piece, feeds ranging from 0.010 to 0.170 are provided. The internal transmission provides eight selective speeds covering a wide range. The changes are made by two levers brought within easy reach of the operating position. Strokes per minute range from 11 to 138 for the 16-in. size to 8 to 102 for the 36-in. shaper. Speeds are shown on a dial.

Coulter Hob Thread Miller Features Camshaft Control

The Type H semi-automatic hob thread milling machine announced by the James Coulter Machine Co., 386 Mountain Grove St., Bridgeport,

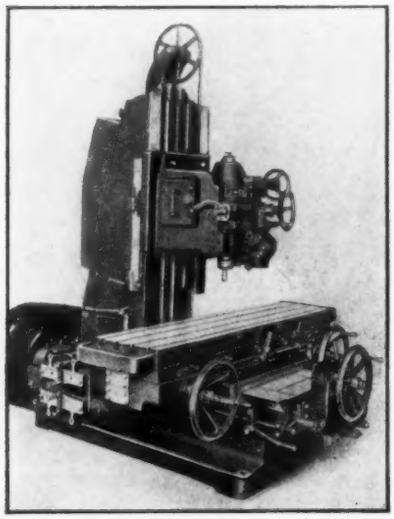
Conn., varies speeds and feeds for various diameters through pick-off gearing. The machine consists of a suitable bed mounted on a substantial base with lubricant tank inclosed. The work spindle has a 4 in. hole and a suitable flanged end on which a universal chuck, a master collet chuck, or fixtures may be mounted. The large milling spindle has suitable taper bearings for take-up adjustments and is driven by a worm and worm gear direct from the motor. By means of camshaft control, it is only necessary to set the hob to suitable depth on the first piece, after which duplication is assured without manual adjustments. The standard machine is equipped with two motors, one for the work spindle and one for the hob spindle, one 12-in. three-jaw hand operated scroll chuck and one hob cutter. The cycle of operations includes: (1) chucking the work, (2) bringing the cutter up to a stop, (3) pushing the starting button. When the hob moves to exact depth the work revolves 1½ times, the hob withdraws and the machine stops, ready for the operator to take out the work and reload. Specifications: Length of bed, 52 in.; swing over carriage, 14 in.; distance from head to hob, up to 21 in.; maximum external thread, 7 in.; minimum hole depends on smallest hob practical; floor space required, 60 x 38 in.; net weight, 3,000 lb.

Jackson Duplex Die Sinker Features Cherry Tool Head

The No. 10 duplex typeless die sinker made by Jackson Machine & Tool Co., 248-250 E. Wesley St., Jackson, Mich., has a cherry tool mechanism mounted at the right of the spindle on the tool head. It is claimed that this tool and the device for its oper-

ation gives this machine a decided advantage in die sinking operations. Narrow or wide semi-circular depressions with straight or nearly straight ends can be made quickly. Its practical application is in squaring up the ends of depressions, forming depressions to make flanges forged on the ends of crankshafts or for cams forged integral with camshafts, and similar depressions in forging dies.

Machine specifications: vertical

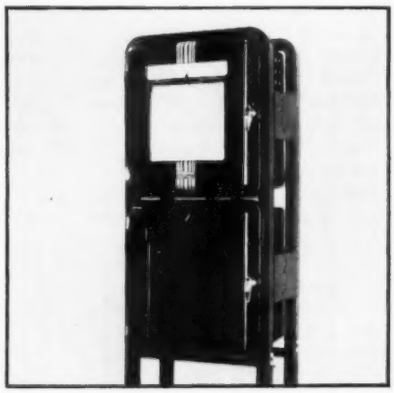


movement of head, 23¾ in.; distance from center of spindle to face of column, 18½ in.; maximum distance from table to end of spindle, 28½ in.; taper hole in spindle, No. 13 B. & S.; spindle speed, 40 to 413 r.p.m.; strokes of cherrying tool, 13 to 138 per min.; cross travel of table, 18 in.; longitudinal travel of table, 56 in.; working surface of table, 18 x 72 in.; net weight of machine, 12,000 lb.

Improved L & N Speedomax Draws Continuous Curve

High-speed recording at a new level of dependability and freedom from attention is said to be possible with the completely redesigned and simplified Speedomax pyrometer offered by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. This instrument draws a continuous curve of moving billet, slab or rail temperature. Showing not only temperature of the work, but also temperature gradient between its ends, this chart is a reliable guide to rolling operations.

A direct-acting potentiometer recorder, the Speedomax has a measuring circuit which is practically identical with that used in Micromax instruments. Instead, however, of balancing by mechanical means, the Speedomax has a motor which balances the instrument with great rapidity whenever a temperature



change unbalances the Rayotube-Speedomax potentiometer circuit. A thyratron relay controls the balancing motor. This motor has a high rate of acceleration to assure fast recording. Available in a number of different ranges between the limits of 650 and 3300 F. Chart speed may be either 4 in. per hr. or 2 in. per min. Where it is desired, signals can be operated by the instrument.

Hull Cell Determines Characteristics of Solutions

Developed by R. O. Hull of the Graselli Chemicals Dept., E. I. du Pont de Nemours & Co., the "Hull Cell" offered by Kocour Co., 4724 S. Christiana Ave., Chicago, Ill., determines current characteristics of electroplating solutions. To determine at what current density it is possible to produce the best, or most economical plate, a solution is placed in the cell and a current passed through it. By adjusting the rheostat so that a predetermined current passes through the solution, the cathode will have a varying current density over its entire surface. By placing this cathode on a graph supplied with the cell, the current density which produces the best plate is determined. The cell also is used for the control

of addition agents which, as a rule, are present in too small a quantity to be analyzed readily. Cathodes are produced from the solutions with varying amounts of the addition agent. These cathodes then are used as standards against which the cathode from the solution under test is compared. The cell also finds use in the development of solutions, as in this manner a single experiment determines the effect of a current density from 2 to 100 amp. per sq. ft.

Gashed Helical Gear Formed Tool Used In "Red Ring" Heavy Duty Gear Shaving Machine

The heavy one-piece frame of the extra heavy-duty "Red Ring" gear shaving machine offered by National Broach Machine Co, 11457 Shoemaker St., Detroit, Mich., is claimed

to give solid support to the cutter head and to the lead screw under the knee. Rigidity is such that cuts of 0.002 in over pins, which is approximately 0.0003 in. on a side, can be taken, with exact measurements after each cut. This machine makes use of a gashed helical gear form tool in mesh with the work gear, with the axes of work gear and cutter crossed at an angle—usually 10 to 15 deg. The cutter gear drives the work gear as the latter is traversed back and forth across the cutter. Stock is removed in fine, hair-like shavings with a true cutting action. Tooth profile, index, eccentricity and helical angle are corrected, and a bright, smooth tooth surface is produced. Horizontal serrations are eliminated. Profile is corrected by the generating action to within 0.0001 in.

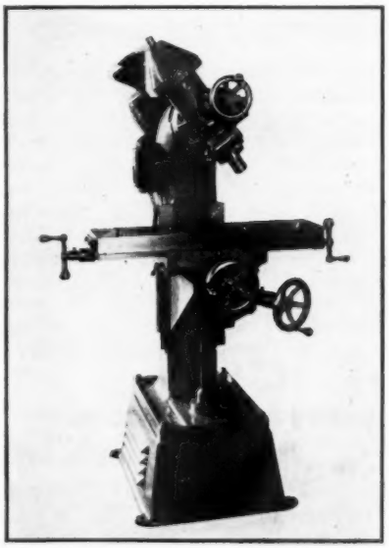
This improved gear shaving machine also provides for crowning gear teeth by means of a cam operating the table. The adjustable cam tilts the table slightly, making it follow a curved instead of a straight path. This makes the teeth thinner by a

slight amount at the end than at the middle. As a result, the ends of the teeth are relieved from bearing against the mating gear, thus avoiding edge bearing of gears. Bearing is taken through the center where the teeth are strongest. Breaking and chipping of tooth corners, frequent in helical gears, is avoided.

The knee of this shaving machine is supported by a 2½ in. feed screw, providing positive location. The cutter head has solid support on both sides of the cutter, to prevent spring. Work table is of heavy box construction, 7½ in. deep, and has a 10 x 35 in. upper surface. All moving parts in the knee have force feed lubrication. Cutter spindle is 2½ in. in diameter. Individual motor drives are used on the cutter spindle, the table and the oil pump. Automatic feed box has been redesigned so that quick settings of 0.001, 0.002, 0.003 or 0.004 in. feed can be rapidly set by a knob located on the outside of the knee. Automatic feed is cut in or out by a second lever on the knee.

Angular Work Done Easily On Jackson Vertical Miller

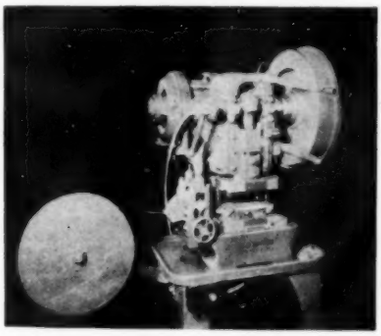
Designed especially for high-speed precision milling, boring and drilling operations, this vertical-head machine offered by Jackson Machine & Tool Co., 248-250 E. Wesley St.,



Jackson, Mich., features the use of two double-row radial thrust ball bearings in the spindle assembly. All feeds are by hand. Pockets, slots, angles and compound angles up to 90 deg. can be machined without disturbing the work on the table. Spindle has a vertical motion of 4 in. by worm and worm gear adjustment. Motor bracket and spindle housing are one unit, with motor anchored to rear of column with hand locknut to permit easy belt adjustment. This whole unit is anchored to the column by three bolts that, when loosened, permit swiveling the spindle 120 deg. either way. The V-belt drive provides five spindle speeds from 200 to 3,000 r.p.m. General specifications: distance from column to center of spindle, 9 in.; maximum capacity of spindle, ¾ in.; vertical spindle travel, 4 in.; vertical adjustment of table, 15 in.; cross travel, 9 in.; longitudinal travel, 18 in.; height over-all, 69 in.; net weight, 1,030 lb.

Tags Made Rapidly In Bates Power Embossing Unit

Developed especially for embossing aluminum number tags, this improved power embossing outfit made by H. O. Bates, 251-257 N. Broad St., Elizabeth, N. J., can be used for making number tags or nameplates in quantities for any identification or

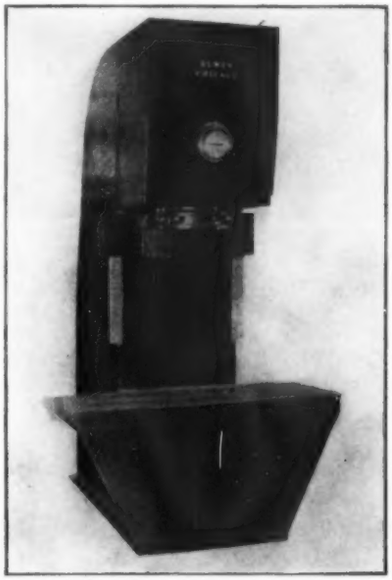


numbering purpose. The press itself is a light-weight machine of well-known make, assembled with motor and drive for operating at a speed of approximately 125 strokes per min. Above the ram is mounted a counter for indicating the total number of tags produced at each setting.

Metal strip carried in the reel is fed through the die-set by a roll feed. This die-set contains the embossing type with upper and lower mating characteristics. These characteristics are followed by a hole punch and cut-off. Following this is a chute which allows the finished embossed tags to drop out of the machine. To change the numbers, the operator may pull each holder out sufficiently to facilitate quick changing of the type. An automatic embossing head can be substituted for consecutive numbering operations.

Elmes Hydraulic Presses Operated by Single Lever

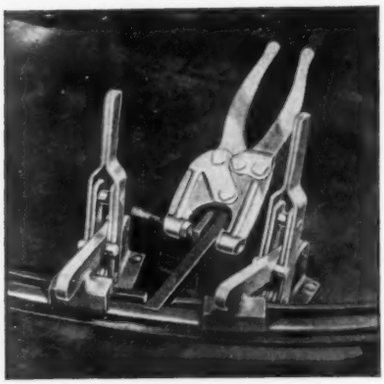
General-purpose, open-side hydraulic presses made by Charles F. Elmes Engineering Works, Morgan & Fulton Sts., Chicago, Ill., are of steel construction with the frame reinforced to give maximum rigidity. The work table is located at a convenient height from the floor and is provided with slots for fastening jigs or fixtures. Moving platen is guided on adjustable gibs located on the frame, it also has T-slots. Control



equipment is located within the housing, only the operating levers and motor starter button are exposed. Operation of the press is by a single lever conveniently located on the right-hand side of the press. Pushing down the lever advances the platen at a high rate of speed. When the work is reached, the platen automatically slows down. Releasing the lever will reverse the platen, which returns at a considerably higher rate of speed than it descended. Stroke of the moving platen can be decreased to cut down the idle movement of the platen.

Detroit Clamping Tools Made for Aircraft Industry

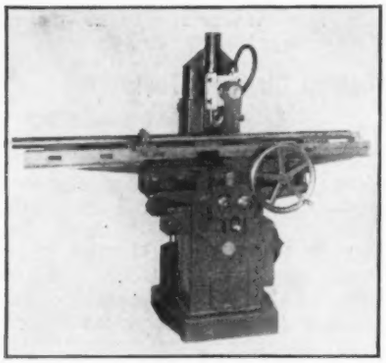
Developed especially for use in the aircraft industry, the two clamping tools shown have been made available by the Detroit Stamping Co., 3427 W. Fort St., Detroit, Mich. These tools also are suitable for use in other industries for clamping and holding production work where limited clamping space or the nature of the job renders larger size clamps unusable. The rapid action No. 220 "De-Sta-Co" toggle clamp, of which two are shown in the illustration, measures only $1\frac{29}{32}$ x $1\frac{5}{8}$ in. at the base and is designed for quick clamping, positive holding and instant release. Raising the operating handle delivers a pressure ratio of 33-to-1 to the clamping arm. Rapid action No. 460 toggle pliers shown in the center measure only $6\frac{13}{32}$ in. long over-all. A lock nut allows for rapid adjustment of the clamping head



from 0 to $\frac{11}{16}$ in. spacing so as to accommodate various thicknesses of work. Closing of the handles exerts a pressure ratio of 75-to-1 at the clamping end of the pliers.

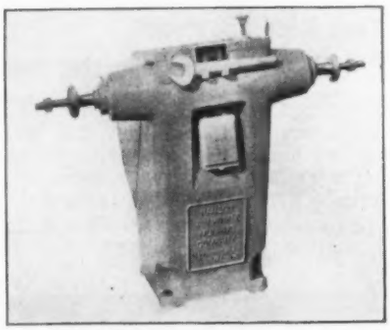
Kent-Owens Milling Machine Cuts Woodruff Keyways

This No. 1-V horizontal milling machine with vertical feed, made by Kent-Owens Machine Co., 958 Wall St., Toledo, Ohio, is arranged especially for milling Woodruff keyways and performing similar operations on long parts. An extra long table is provided to furnish adequate support for the work throughout its entire length. The table is advanced lengthwise by a rack and pinion operated by a large handwheel. Dogs are set along the face of the table to operate a quick-acting flag stop to position the work for each successive keyway. After the work has been properly set, the automatic vertical movement of the head is ob-



tained hydraulically. Adjustable dogs permit any desired combination of rapid traverse and feed within the limits of the machine.

The machine is driven by a standard ball bearing motor mounted at the rear of the machine. Between the motor and the cutter there are only two gear contacts, one of which is a pair of pick-off gears providing a spindle speed range of 100 to 1,335 r.p.m. with a 1,200 r.p.m. motor. With the hydraulic actuation of the head movement, an infinitely variable feed rate from ¾ to 80 in. per min. can be obtained. Rapid traverse is at the rate of 300 in. per min. Changes in feed rate are obtained by adjusting dials at the front of the machine. Also shown is a special automatic clamping member mounted on the overarm. This is a spring backed clamp which contacts the work shortly before the actual cutting begins, so that the work is securely held near the point of milling throughout the cutting cycle.

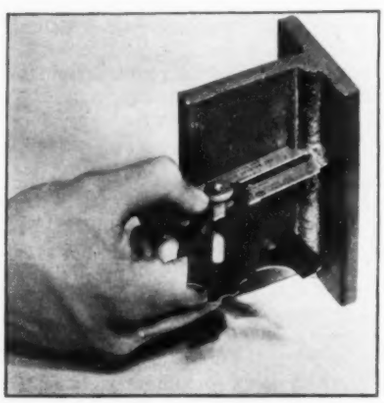


Buffing Lathe Offered By Hanson-Van Winkle-Munning

The Type MO buffing lathe developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J., is designed for a range of work not requiring a heavy-duty machine. A generous overhang is provided for clearance. The body of the lathe is a heavy one-piece casting having a base dimension of 24 x 20 in. Drive is by V-belt, with quick belt changing a special feature. Any spindle speed from 1,800 to 3,600 r.p.m. can be obtained by changing the motor sheave pulley.

Fillet Welds Checked Quickly With G. E. Fillet-Weld Gage

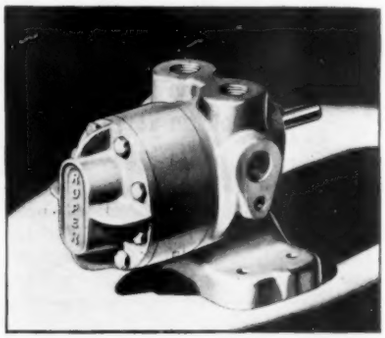
Welding inspectors and operators can check the size of fillet welds on jobs which have to meet rigid specifications quickly by using the fillet-weld gage developed by General Electric Co., Schenectady, N. Y. This gage is of simple construction, consisting



of three stainless-steel stampings held together by a bolt and a knurled thum-nut. Either convex, concave or standard fillets can be checked merely by fitting the edge of the gage flush against the work so that the indicating portion of the gage rests on the weld bead. The gage can be used on fillets of the following sizes: $\frac{3}{16}$, $\frac{5}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{7}{16}$, $\frac{1}{2}$, and $\frac{5}{8}$ in. These sizes are clearly marked on the gage.

Roper Rotary Pumps Feature Hydraulic Balance

A line of rotary pumps announced by the Geo. D. Roper Corp., Rockford, Ill., includes pumps of 1 to 1,000 gal. per min. capacities at speeds up to 1,800 r.p.m. and against pressures up to 1,000 lb. per sq. in. At present 21 different drives and mountings are available, ranging from ordinary foot,

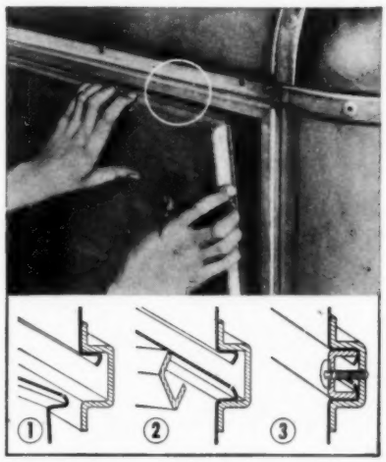


hub and flange mounting heads to complete bedplate units for direct motor drive. An outstanding feature claimed for this line of pumps is hydraulic balance which equalizes internal pressure at all points and absorbs all shock or thrust from the power end of the drive shaft. Other features include a choice of helical, spur or herringbone gears, a choice of seals, sleeve or roller bearings, built-in or external relief valve, and eight different piping arrangements.

Lindsay Structure Combines Sheets and Frames In Units

Fabricated by mass production methods to within ½ in. of any desired dimension, Lindsay Structure materials being made available by Dry-Zero Corp., Chicago, Ill., are claimed to involve an entirely new principle that makes possible increased strength without increased weight. In the Lindsay Structure, the sheets are pulled into tension between the framing members. These "Pre-Tensed" sheets resist any movement of the framing and the load is distributed over their entire area.

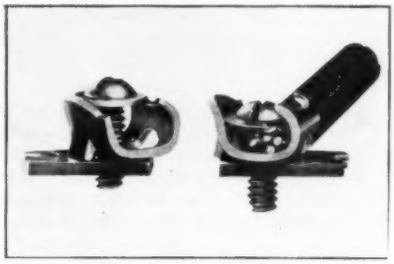
Developed by Harvey B. Lindsay, president of Dry-Zero Corp., this method of construction provides the



following advantages: (1) it eliminates cross-braces, gussets, and struts by placing the sheets under tension between the framing members; (2) it creates a union between the sheets and framing that approximates the full strength of the sheet; and (3) it provides ease of assembly and disassembly from the outside, equivalent to the simplest bolted construction.

Square D Connector Holds Wire at Any Angle

Called the "Universal Speed Connector," a solderless connector developed by the Square D Co., Detroit, Mich., will take from No. 14 to No. 4 wire and is claimed to save time in wiring. The connector is free to rotate around the screw, thus allow-



ing wire to be inserted from almost any angle. This feature is important where large wires are used in a limited space. The connector is self-centering so that there is no need to wind the wire around the stud, or to separate stranded conductors. As the screw is tightened, the lug is forced to one side and the wire is gripped tightly.

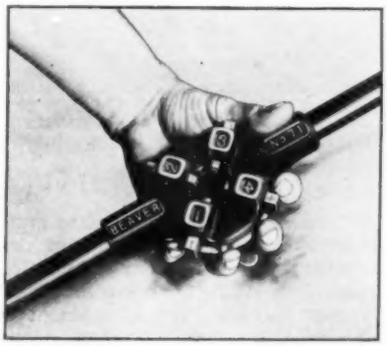
"Thor-Nado" Portable Hammer Features Sling-Shot Drive

The "Thor-Nado", an electric hammer featuring the new "Sling-Shot Drive" is the latest product of the Independent Pneumatic Tool Co., 610 W. Jackson Blvd., Chicago, Ill. Although this tool measures only 13½ in. long and weighs only 14 lb., this powerful hammer is adopted to a wide variety of heavy-duty applications, including star drilling, channeling, chipping, cleaning, scaling, cutting, gouging, beading, caulking, and seaming. The "Sling-Shot" drive is a method of driving the piston in a hammer action by means of a shock-proof rubber connection. This drive whips the piston back and forth at a speed of 1600 blows per

min., acting as both power accumulator and shock-absorber. There is no metal connection between the piston and the gear train and motor. The blow of the piston is not felt by the operator, nor is it transmitted to the gear or motor.

Beaver Threading Tool Has Self-Centering Chuck

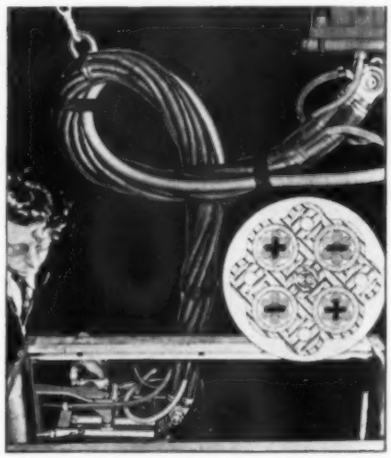
The Series 71 pipe and bolt threader developed by Beaver Pipe Tools, Inc., Warren, Ohio, threads pipe from ⅛ to ¾ in., right or left hand, and bolts from ¼ to 1 in., right or left hand, coarse or fine thread. More than 100 kinds and sizes of dies are available for this tool. The die bosses project above the face of the tool body so



that chips clear easily. The self-centering universal chuck provided with this tool requires no loose bushings. The tool is available in ratchet and non-ratchet models. Dies used in this tool are adjustable for oversize or undersize threads. The dies adjust as a single unit.

Progressive Welding Cable Uses Four Current Lines

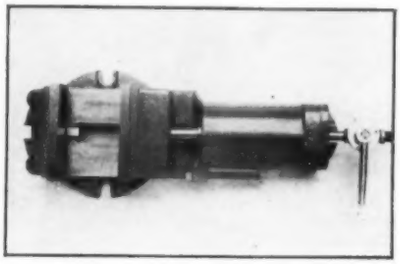
The all-in-one "No-Kik" welding cable offered by Progressive Welder Co., 3001 E. Outer Drive, Detroit, Mich., incorporates welding current cables, water cooling lines and control cables sheathed in a single, seamless rubber covering of maximum flexibility. This cable employs four current carrying cables arranged so that the duplicate positive and negative cables neutralize each others' magnetic fields. At the gun and transformer ends, each pair of positive and negative cables are joined together to provide a single bolt solid attachment. The seamless rubber covering maintains cables in relative position between the gun cooling



lines and the control cable which forms the core of the unit. This cable is currently offered in 250,000, 400,000 and 750,000 cm. capacities and in 6, 8 and 10 ft. lengths.

Larkin Pneumatic Vise Designed for Production Work

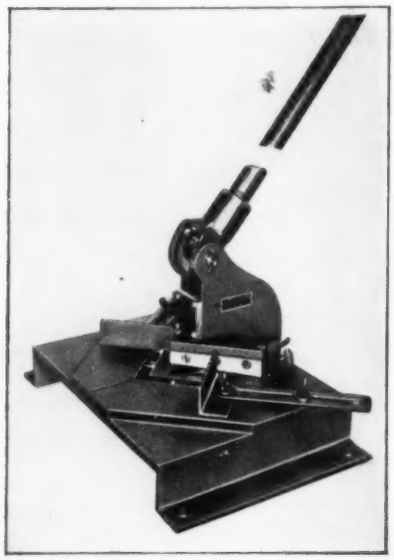
Pneumatically operated, this vise offered by the Larkin Air Vise Co., Portland, Conn., is designed for production machine work. Its use is claimed to save much time in handling material, particularly where operations are short and a number of pieces are worked from one set-up. It is adaptable for bench work, as well as for such machining operations as milling, shaping, planing,



drilling and tapping. This vise is available in five sizes ranging from 4 to 8 in. jaw width. It is supplied regularly with hardened and ground jaws, flanged base and hand-operated control valve. Special jaws can be provided to fit any work. Swivel and universal bases, as well as foot-operated valves, are available. Depth of jaw ranges from 2¼ to 3½ in., and maximum opening from 3¼ to 5 in.

Kidder Sheet Metal Notcher Features Adjustable Blades

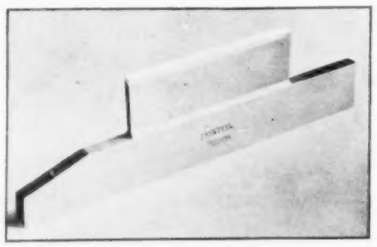
Having capacity to cut a 5 x 5 in. 90 deg. notch in No. 20 gage mild steel, this No. 39 sheet metal notcher offered by J. F. Kidder Mfg. Co., Inc., 426 Colchester Ave., Burlington, Vt., weighs only 65 lb. It occupies a bench space measuring 12 x 18½ in.



Gages are adjustable quickly for a wide range of work. Blades may be sharpened and adjusted to compensate for wear.

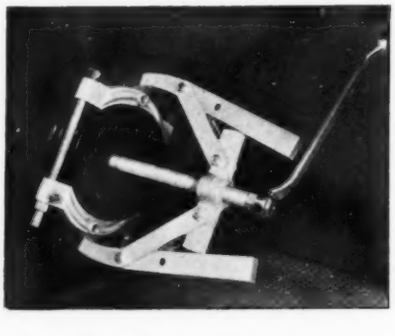
Pittsburgh Segment Saws Permit High Cutting Speeds

The fine pitch segment saw announced by Pittsburgh Saw & Tool Co., 75 Sycamore St., Etna P. O., Pittsburgh, Pa., features segments which are held in place with wedges. These segments are driven by the full width of the saw body. Broken segments can be replaced easily simply by removing the key and the wedge. Design of these saws is claimed to allow increased cutting speeds with fast feeds. These saws are available in 14 to 60 in. diameters with kerfs of ¼ to ½ in. The smaller saws use 15 segments, while 45 segments are required for the larger saws.



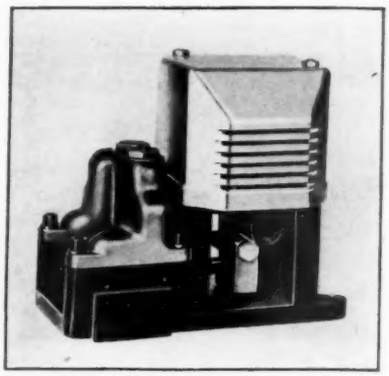
Fansteel Offers Tantung Centerless Grinder Blades

Centerless grinder rests for any type of machine or grinding operation are available from the Fansteel Metallurgical Corp., North Chicago, Ill., faced with tough Tantung hard facing alloy. The facing, made in bar form, is affixed to the steel supports by a brazing process. Tantung facing can be applied to existing blades; worn out blades can be reclaimed by applying the facings. Tantung is composed of hard particles of tantalum and tungsten carbide, uniformly distributed and embedded in a matrix.



Owatonna Sheave Attachment Distributes Pulling Strain

A pulling attachment to remove multiple V-drive sheaves has been developed by the Owatonna Tool Co., Owatonna, Minn., for use with "Gripomatic" pullers. The attachment is applied at the base of the V-groove and the pulling strain is distributed over a large area. Maximum capacity of the No. 680 sheave puller attachment is 10 in. It will pull any sheave regardless of the number of V-grooves up to this diameter. For use on sheaves from 8 to 10 in. the No. 1004 Gripomatic puller is recommended with the sheave pulling attachment.

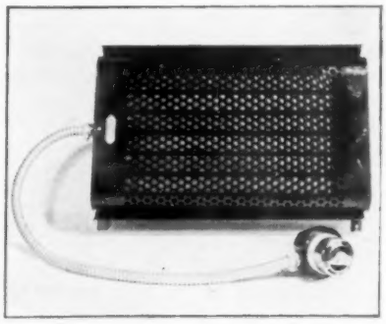


High-Speed Air Valve Developed for Welding Guns

Ross Operating Valve Co., Detroit, Mich., has developed a special solenoid-operated air valve for high-speed operation of welding guns. This valve is now regularly delivering 400 welds per minute on production jobs, and is claimed to have operated successfully at even higher speeds.

Westinghouse Air Heaters Are Wall or Floor Mounted

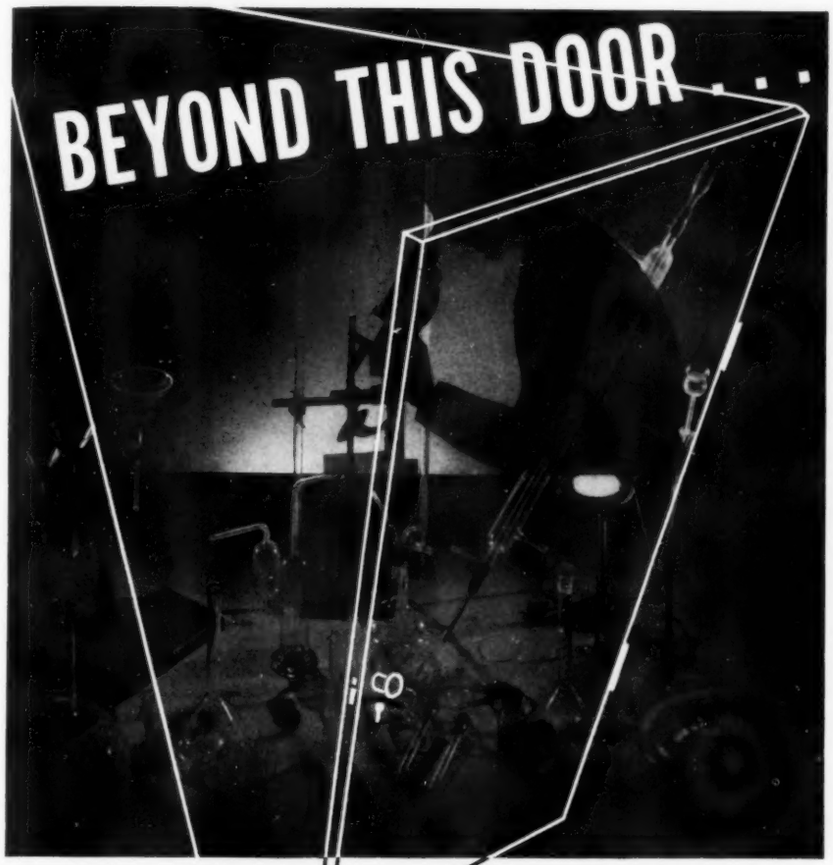
A line of wall and floor mounted air heaters, constructed to solve heating problems for specific applications, has been announced by Westinghouse



Electric & Mfg. Co., Mansfield, Ohio. These heaters are particularly suitable for use in crane cabs, truck houses, valve houses, locomotive cabs, and scale rooms. They are designed for use with either a three-heat hand switch or a Type AA thermostat. The wall mounted air heaters range from 1,000 to 4,500 watts rating and operate on 115, 230 or 440 volts. The floor mounted air heaters have approximately the same heating surface and the same wattage rating, but they are made only to operate at 115 or 230 volts.

Surface Plate Equipment Speeds Layout Work

A line of accurate surface plate equipment is offered by The Challenge Machinery Co., Grand Haven, Mich., for use in inspection, layout, assembly and other surface plate operations,



. . . IT'S TOMORROW

Time never quite catches up with the men in our Research Laboratories. They deal largely with the possibilities of tomorrow. Their job is to obsolete the present, to constantly seek *better* methods, *better* equipment, *better* ways to make *better* Carboloy.

Often of far-reaching importance are the things they do. They impregnated Carboloy with diamond particles . . . and now those who dress grinding wheels have a diamond dresser that requires no resetting—no expensive stones . . . they applied this same material to the mining field—and it bids fair to revolutionize core drilling practice . . . they took microscopic particles of carbide—100 trillion to a pound of Carboloy—and *"split them in two"* to produce grades of Carboloy having an order of performance and life never before attained. . . . *NOW* they're perfecting a special extrusion process that turns out Carboloy *by the yard*—replaces 300-ton hydraulic presses. Things of this order they have done to mould "visions" into realities.

The "Tomorrows" of these men have made many things possible *today*. Carboloy is no longer just a cutting tool or a wire drawing die. It plays a part not only in *making* products but also has become an *actual part of* many products and machines. As a wear-resistant part, Carboloy is found in oil well pumps, spray guns, bread slicing machines, hydraulic equipment, business machines, refrigerating machines, saw sharpeners, machine tools, communication equipment, fish rods, etc. It helps to make such things as rayon, baby food, tomato juice, carbon resistors and coated welding rods.

Carboloy uses exceed the boundaries of your machine shop or wire mill. Carboloy is the Metal of Tomorrow with a thousand and one uses Today!

CARBOLOY COMPANY, INC., 11149 E. 8-Mile Road, DETROIT, MICHIGAN

CHICAGO • CLEVELAND • NEWARK • PITTSBURGH • PHILADELPHIA • WORCESTER, MASS.

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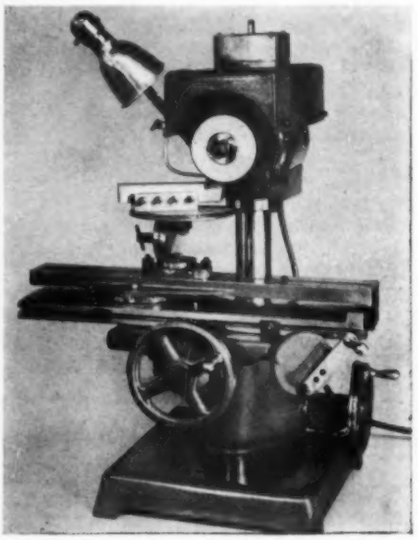
TUNGSTEN CARBIDE—TANTALUM CARBIDE—TITANIUM CARBIDE

FOR CUTTING, DRAWING, SHAPING, EXTRUDING METALS AND NON-METALLICS

★ FOR REDUCING WEAR ON EQUIPMENT OR PRODUCTS YOU USE OR MAKE ★

New Grinder Quickly Grinds Chip Breakers In Carboloy Steel-Cutting Tools

A chip breaker grinder especially adapted to the safe, rapid grinding of chip breakers in steel-cutting cemented carbide tools is announced by Carboloy Company. The machine is equipped with a simple Universal fixture that can be quickly set to produce a



chip breaker exactly to specifications. Chart furnished with each grinder gives exact setting for each of the three protractors on the universal fixture. By means of this, settings can be made to meet any given tool specifications, and exact duplication at any time is possible, a particularly desirable feature for regrinding Carboloy steel cutting tools. Write for leaflet GT-121 containing complete details.

New Booklet Shows How Warner & Swasey Applied Carboloy Tools To 1500 Operations

In view of the noticeable trend toward the use of carbide tools broadly throughout the shop rather than as a special tool for difficult jobs, a new booklet recently issued by Carboloy Company is of unusual interest.

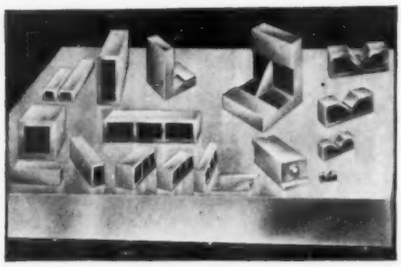
This 12-page booklet tells in detail how Warner & Swasey Company applied cemented carbide tools on approximately 1500 steel and cast iron operations, resulting in a 43% average increase in machine capacity on those jobs. Blueprints of tools used, time studies, and illustrations of typical applications are included. Send for booklet GT-403.

New Engineering Bulletin Gives Recommendations For Machining Ampco Metal

This new Carboloy Engineering Bulletin lists specific speeds and feeds for rough, semi-finish and finish machining of Ampco Metals with Carboloy cemented carbides. Bulletin also covers tool design, coolants, etc. Send for Bulletin GT-119.

Carboloy Drill For Maintenance Work Drills Holes In Concrete, etc., 75% Faster

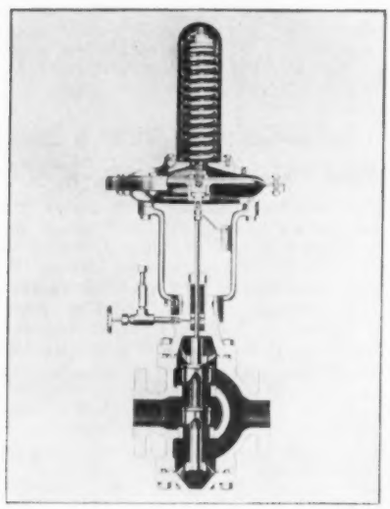
Tip your maintenance man off to the Carboloy Masonry Drill. Drills concrete, tile, brick, slate, porcelain, etc., 75% faster than old methods. Send him leaflet GT-103.



as well as for some bench operations. This equipment consists of ribbed and box parallels in several sizes, V-blocks up to 6 x 8 x 8 in., adjustable leveling blocks to compensate for odd dimensions, and a wide range of angle plates for holding or clamping work. Each unit is made from fine-grained iron, machined smooth, square and to accurate dimensions. All of this equipment is furnace normalized.

Foxboro Stabilflo Valves Respond Accurately to Control

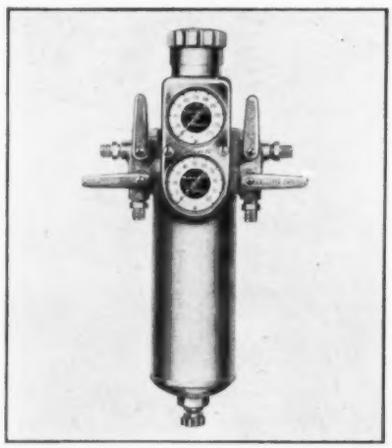
The improved line of "Stabilflo" controlled valves announced by the Foxboro Co., Foxboro, Mass., are designed for accurate response to the demands of a control instrument without sacrifice of rugged construction. As equipped with a wide range V-port plunger, the valve has a



rangeability of 50 to 1. When this valve is lifted off the seats, the initial clearance flow is 2 per cent. From this 2 per cent flow to 100 per cent flow, the valve gives equal percentage increases in flow for equal amounts of valve lift. The V-port plunger is screwed and pinned to the valve stem and is designed for easy field reversal.

DeVilbiss Air Transformer Cleans and Regulates Air

An improved air transformer for feeding clean, moisture-free air at uniform, regulated pressure to paint spray guns has been announced by The DeVilbiss Co., Toledo, Ohio. Listed as Type HLC, this transformer has increased capacity, improved filtering facilities and sensitive regulation and control of pressure. It will handle in excess of 50



cu. ft. of air with a minimum of pressure drop. It will pass ample air for two production spray guns in continuous and simultaneous operation or for three spray guns in ordinary, intermittent production use. Features include a large synthetic rubber regulator diaphragm, an improved operating mechanism, and a large, conveniently located regulator knob. A mechanical filtering device gives continuous filtering efficiency without wear or attention.

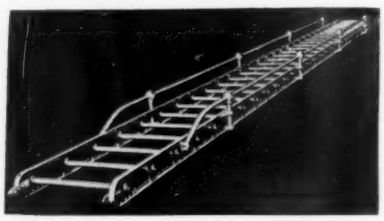
Shafer Double-Row Bearings Available in Two Series

Series DE self-contained double row angular contact type roller bearings made by Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill., are available in DE-200 series, sizes from 3.1490 to 5.9045 in. bore, and DE-300 series, sizes from 1.9680 to 5.1171 in. bore. Concave rollers operate between convex races, the one-piece outer race having two ground race-

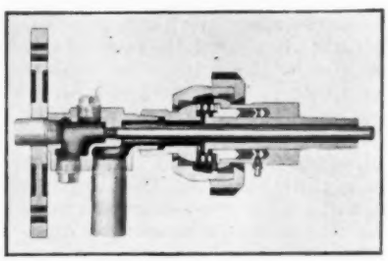
ways. The concave roller design provides self-alignment within the bearing itself; it also provides capacity for radial loads, for thrust loads in either direction or for any combination of radial and thrust loads. The design permits the use of a maximum number of rollers, providing generous bearing capacity in a compact assembly.

Spark-proof Aluminum Ladder Has Handrails for Safety

Especially suited for the use of the storekeeper or maintenance machinist in industrial plants, the Type 800 ladder announced by the Aluminum Ladder Co., 104 Adams St., Tarentum, Pa., is equipped with handrails on both sides and steel or



aluminum spikes on the bottom. Aluminum spikes do not throw a spark and therefore are recommended for use around inflammable materials. This ladder can be supplied in lengths up to 36 ft., and in various widths. Rungs are corrugated to prevent slipping.



Barco Revolving Joints Supply Fluids To Drums

Revolving-type flexible ball joints made by Barco Mfg. Co., 1801 Winnemac Ave., Chicago, Ill., are used to supply steam, gas or fluids from a fixed or stationary supply pipe to a rotating drum or other member without leakage. The sleeve is the only part of the joint that revolves. This sleeve also slides out and in to take care of any end play in the revolving drum. The double ball design provides flexibility to compensate for any misalignment or eccentricity of movement. An adapter is used when it is desired to feed two different fluids into the revolving drum or to syphon out condensate through the same opening. Five standard sizes are available for ½, ¾, 1, 1¼ and 1½ in. pipe connections.

Synchronous Motor Control Developed by General Electric

General Electric Co., Schenectady, N. Y., has announced the development of a synchronous motor control which features the slip-cycle impedance SCI relay. With this control the field cannot be applied until the motor has reached a speed at which it can synchronize its load. This speed is easily set on a trial start by an adjusting screw on the front of the relay. Undesirable current and torque fluctuations are avoided, because the field can in no case be applied unless the load can be synchronized. The control waits until the motor reaches the correct speed, and then selects an instant of favorable angular relation of stator and rotor poles to apply the field in order to take advantage of the inherent synchronizing ability of the motor.

Cincinnati Grinder — Correction

Our attention has been called to an error which appeared in a recent description of the new 12-in. hydraulic universal grinding machine made by Cincinnati Grinders, Inc., Cincinnati, Ohio (*AM*—Vol. 84, page 105). This grinder has an hydraulic table feed having an accuracy of reversal at any table speed within 0.004 in. This value incorrectly was given as 0.044 in. in the original description.

Barnes Bandsaw Stock Now Packaged In Cartons

Lengths of metal-cutting bandsaw stock up to 100 ft. in widths ½ in. and under now are packaged in a flat carton, with one end of the coil readily accessible, by W. O. Barnes Co., Inc., Detroit, Mich. To remove a length of saw stock from the carton, the user holds the carton by the upper left corner and pulls the saw stock from the small opening in the upper right corner, cuts off the length, notes the amount on the perpetual inventory record on the carton and replaces the carton in stock. The coil cannot run wild; this is particularly important in the case of narrow widths used for contour sawing and die cutting. The 12-in. carton allows the saw to coil loosely, eliminating blade checking. A window in the carton permits inspection of the stock inside.

Columbian "Co-Ro-Felt" Pad Made for Disk Sanders

The "Co-Ro-Felt" light-weight backup pad developed for disk sanders by the Columbian Rope Co., Auburn, N. Y., has a molded plastic center and is available in 7, 8 and 9 in. nominal sizes. Both the center and

How to Save Money on Steel

● Reduced shop labor costs . . . Elimination of heat treating failures, costly testing and retreating . . . less clerical expense—these are money-saving advantages regularly reported by manufacturers who standardize on Ryerson Certified Steels.

Steel buyers know exactly what they're getting when they order from Ryerson. These uniform high quality steels are made to close range specifications. They are free from hard or soft spots and can be depended on for uniform working and forming qualities. Spoilage, breakage, and irregularities are practically eliminated.

A special quality control plan on Alloy Steels assures uniform heat treatment response. Entire heats are selected and complete chemical and physical properties, and exact heat treating characteristics are sent with every order to guide the heat treater in securing dependable, uniform results. He does not have to test. He takes no chances. Spoilage and re-treating are eliminated and a sound, dependable job is assured.

Ryerson Certified Steels stocks are complete and diversified. You can save time, trouble and money by concentrating all steel requirements with this one dependable source of supply. Everything from the heaviest structural to the smallest rivet—from mechanical tubing to welding rod is carried in stock for Immediate Shipment. If you do not have the current Ryerson Stock List we will gladly send you a copy.

RYERSON PRODUCTS *Include:* Beams, Structurals, Channels, Angles, Tees, Zees, Hot Rolled Bars, Bands and Hoops, Floor Plate, Plates (over 15 kinds), Sheets (over 25 kinds), Alloy and Tool Steels, Heat Treated Alloy Bars, Stainless Steel, Cold Finished Shafting, Strip Steel, Flat Wire, Mechanical Tubing, Boiler Tubes and Fittings, Welding Rod, Rivets, Bolts, Nuts, Washers, Concrete Reinforcing, Babbit Metal and Solder.

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Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON CERTIFIED STEELS

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DON'T GAMBLE
WITH DOUBTFUL SCREWS!

Unusual equipment like this eliminates "gamble."

SPECIFY QUALITY-CONTROLLED PARKER-KALON SOCKET SCREWS

IT doesn't cost you a penny extra to use Parker-Kalon Socket Screws! And, you get unique protection against any "doubtful" screws . . . screws that might play hob with assembly efficiency, or fail in service.

Such protection has become available only since Parker-Kalon established a $250,000 laboratory to provide rigid quality control. Today, every Parker-Kalon Socket Screw is *bound* to measure-up in all characteristics after passing the 16 Parker-Kalon Quality-Control tests.

Tangible evidence of all this care is the Guarantee you get in every box. Order PARKER-KALON next time! For free samples and local distributor's name, write: Parker-Kalon Corp., 194-196 Varick Street, New York.

Quality-Controlled

16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.

PARKER-KALON
COLD-FORGED
Socket Screws

the flexing surface are made of rope fibre bonded and molded at the same time to prevent the two from separating. Pad can be used for sanding and polishing metal or wood surfaces. The 7-in. pad weighs less than ½ lb. Each pad is balanced to cut down vibration.

NEW MATERIALS

"Black Bonis" Material Provides Smooth Surfaces

An improvement over the "White Bonis" previously available, "Black Bonis" now offered by St. John X-Ray Service, Inc., 30-20 Thomson Ave., Long Island City, N. Y., is supplied in paste form. This paste is dissolved in water and applied under air-pressure over hot dies and cores to protect the surfaces of the tools and to provide smooth surfaces on die castings. Castings made in dies protected with this material require less cleaning and buffing before plating. At the same time, it is claimed that the life of the die is increased. The material acts as a lubricant and insulator. It is non-inflammable and non-poisonous.

TRADE PUBLICATIONS

ABRASIVE CUTTING-OFF Details of bench and pedestal types of wet abrasive cutting-off machines are provided in a 4-page illustrated folder available from Porter-McLeod Machine Tool Co., Hatfield, Mass.

AFTERCOOLERS Engineering features and specifications of a line of aftercoolers are provided in an 8-page illustrated bulletin, No. 186, issued by Pennsylvania Pump & Compressor Co., Easton, Pa.

BATTERIES A 4-page folder issued by the Edison Storage Battery Div. of Thomas A. Edison, Inc., West Orange, N. J., provides features of the new Edison D-type cell.

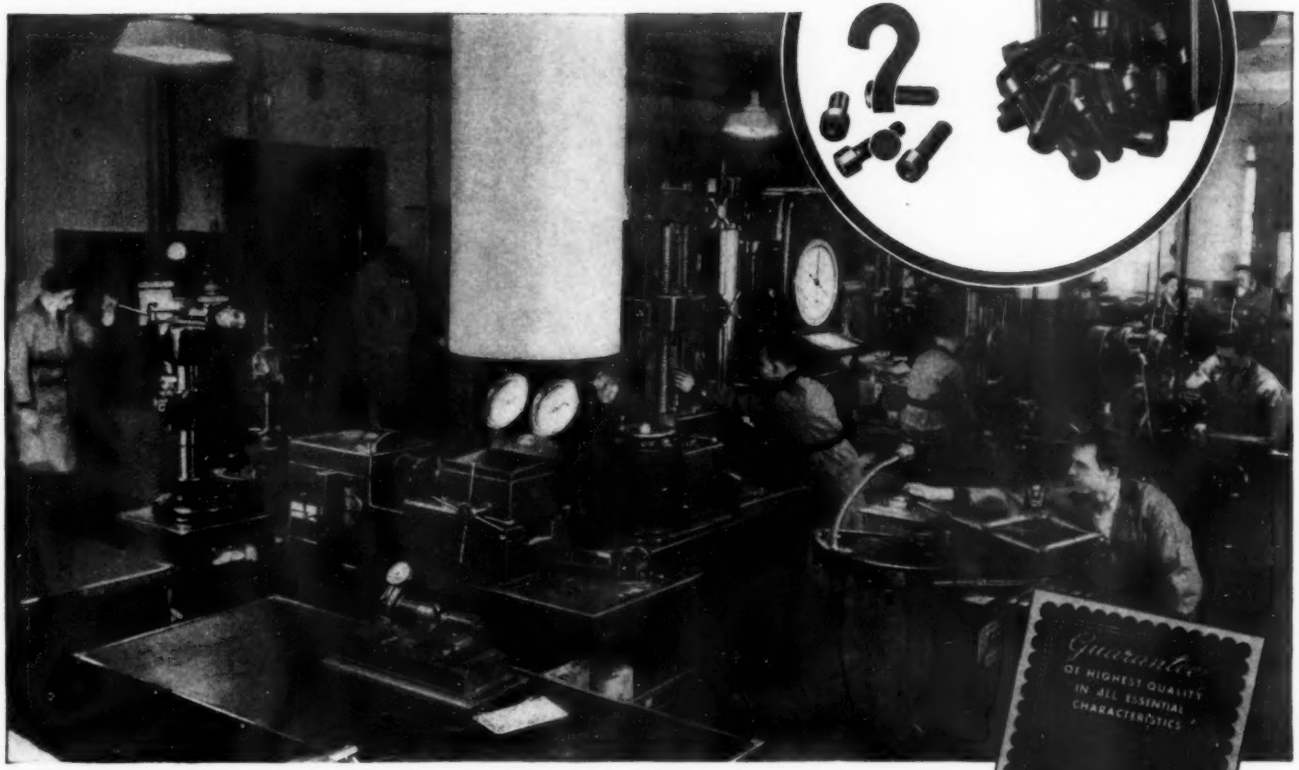
BEARINGS 24 pages of specifications concerning "Ledaloyl" self-lubricating bronze bearings are contained in Catalog No. L-2, issued by Johnson Bronze Co., 515 So. Mill St., New Castle, Pa.

BELT FASTENERS Bulletin No. V-200, issued by Flexible Steel Lacing Co., 4607 Lexington St., Chicago, Ill., describes a line of "Alligator" V-belt fasteners for cross woven-fabric V-belts.

CARBURIZING Characteristics of "Perliton 45" liquid carburizer are provided in a 4-page illustrated

NO *Doubtful Few*

To "Gum-Up" Fastening Jobs



. . . When Parker-Kalon's Quality-Control Laboratory guarantees fastening devices

EVEN a few imperfect screws in a box can "gum-up" assembly work . . . waste time, boost costs, fail to make satisfactory fastenings. That's why thousands of plants specify Parker-Kalon and avoid all troubles caused by the "Doubtful Few."

Parker-Kalon Fastening Devices are made to standards that permit no "Doubtful Few" . . . standards that could only be attained when Parker-Kalon established a $250,000 Quality-Control Laboratory. Without counterpart in the industry, this laboratory applies a unique scientific control-routine to insure that Parker-Kalon Fastening Devices always work right and hold tight.

It pays to buy Hardened Self-tapping Screws, Socket Screws and other fastening devices that are made in the most modern plant in the screw industry. Parker-Kalon Corp., 194-196 Varick St., New York.

COSTS NO MORE to get *this Parker-Kalon Quality-Control Guarantee with every box of . . .*

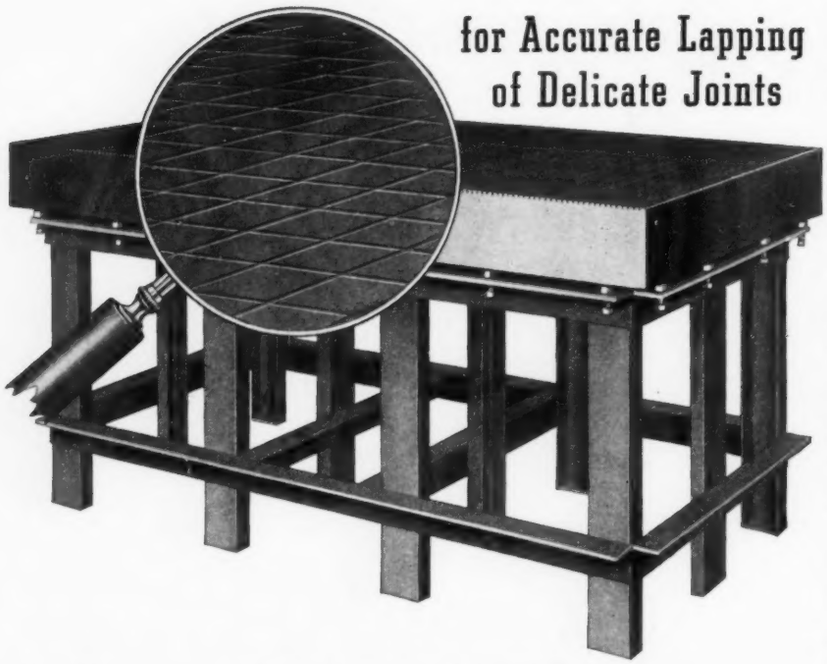
Hardened Self-tapping Screws
Types, sizes, head-styles for every assembly of metal or plastics

Cold-forged Socket Screws
Cap Screws, Set Screws, Stripper Bolts made to a new high standard of quality

Wing Nuts-Cap Nuts-Thumb Screws
Cold-forged . . Neater, Stronger

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

Quality-Controlled **PARKER-KALON Fastening Devices**



for Accurate Lapping of Delicate Joints

Use a CHALLENGE *Semi-Steel* LAPPING PLATE

● This plate permits you to do a difficult job with ease and precision. It is specifically designed to assure a perfect fit when lapping in metal to metal joints on which no gaskets, shellac, or other type of sealer is used.

As shown in the magnified view above, Challenge Semi-Steel Lapping Plates have 1/16-inch grooves, spaced 1/2-inch apart, running the full length and width of the surface.

Challenge Lapping Plates are made of the finest semi-steel, specially heat treated and carefully machined. They provide a durable, dependably accurate surface. Recommended for use on crank cases, cylinder heads, end bells, gear housings, and other parts that must be lapped perfectly to prevent possible oil leaks.

These plates are built to order in sizes ranging from 8x8 to 54x144 inches. They may be purchased with or without the Challenge all-steel arc-welded stand which is equipped with closely-spaced lock leveling screws that enable the user to keep the lapping plate perfectly level. Ask for complete information and prices.

Sign and mail the coupon for special illustrated bulletin, giving full details on Challenge Semi-Steel Lapping Plates; also current catalog showing the full line of Challenge Time and Labor-Saving Devices for Tool and Machine Industries. There's no obligation.

THE CHALLENGE MACHINERY CO. • GRAND HAVEN, MICHIGAN

CHICAGO, 17-19 E. Hubbard St. Challenge 200 Hudson Street, NEW YORK

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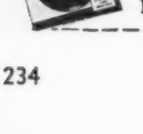

FREE CATALOG — Illustrates and describes Challenge Time- and Labor-Saving Devices for Tool and Machine Industries.

Name_____

Full Address_____

folder, Form 2-158, issued by E. F. Houghton & Co., Third, American, and Somerset Streets, Philadelphia, Pa.

"CEROMATRIX" Characteristics, physical properties and uses of "Ceromatrix", a low-temperature melting alloy which expands slightly on solidification, are detailed in a 36-page illustrated booklet entitled "The Ceromatrix Manual" published by Cerro De Pasco Copper Corp., 44 Wall St., New York, N. Y.

DIE SECTIONS Jessop Steel Co., 595 Green St., Washington, Pa., has issued a wall chart giving specifications of rolled composite die sections.

DRILLS Features and specifications of Cleereman jig borers and drilling machines are provided in a 24-page illustrated bulletin, No. 200, issued by Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill.

FINISHING A review of the various methods of applying lacquers and enamels to metal products has been published by Maas & Waldstein, 438 Riverside Ave., Newark, N. J.

FLOORING Use of "Basolit" in constructing acid-resistant floors is discussed in a leaflet issued by Nukem Products Corp., 66 Niagara St., Buffalo, N. Y.

GRINDING A four-page illustrated folder issued by Porter-McLeod Machine Tool Co., Inc., Hatfield, Mass., describes and provides specifications of a line of bench and pedestal type one-inch wet abrasive cutting-off machines.

HARDENING Features of the "Ammogas" furnace for bright hardening die blocks are provided in a 6-page illustrated folder, No. F-8541, available from Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

HEAT-TREATING A series of leaflets offered by Bellis Heat Treating Co., Branford, Conn., discusses the "Lavite Circ-El-Therm" line of heat-treating equipment.

HOBBING Features of the Type V vertical hobbing machine, along with dimensions and other specifications, are included in a 4-page illustrated folder available from Barber-Colman Co., Rockford, Ill.

HYDRAULIC PRESSES Bulletin No. 103 published by the Denison Engineering Co., 236 N. Water St., Columbus, Ohio, describes features of Type DLSC1 vertical hydraulic presses for straightening, forcing and general production pressing operations.

INSTRUMENTS An eight-page illustrated bulletin issued by Brown Instrument Co., Wayne & Roberts Aves., Philadelphia, Pa., describes

features of the company's new line of recording and controlling thermometers and pressure gages.

LATHES South Bend Lathe Works, 287 E. Madison St., South Bend, Ind., has issued a 112-page catalog, said to be the most complete ever published. It contains over 250 illustrations and includes specifications of 75 different types and sizes of lathes for production manufacturing, tool room and general shop work.

LUBRICATION Bulletin J, published by Bijur Lubricating Corp., Long Island City, N. Y., discusses "Fourteen Reasons for Automatic Lubrication."

MATERIALS HANDLING Catalog No. 1339, published by Stephens-Adamson Mfg. Co., Aurora, Ill., provides 8 pages of features and specifications of a line of car pullers, hoists and winches.

MOTOR-GENERATOR Features of a line of 50–150 kw. synchronous motor-generator sets are provided in leaflet No. GEA-1945A, offered by General Electric Co., Schenectady, N. Y.

MOTORS Heavy-duty motors of ⅛–½ hp. for blowers, air compressors, small machine tools and other applications, are described in Leaflet F-8491, available from Dept. 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PIPE TOOLS A 4-page illustrated folder offered by Beaver Pipe Tools, 370 Dana Ave., Warren, Ohio, discusses features of the Model B ⅛–2-in. pipe and bolt machine.

PUSHBUTTONS A line of standard-duty pushbuttons for a.c. and d.c. pilot circuits is described in Descriptive Data 15-020, available from Dept. 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SAFETY "How To Select Protective Devices for Low Voltage Power Circuits," a 16-page illustrated bulletin, No. GEA-2634, has been published by General Electric Company, Schenectady, N. Y.

SWITCHES Details of a line of diaphragm-type pressure and vacuum switches are provided in Bulletin No. GEA-821G, available from General Electric Co., Schenectady, N. Y.

VENTILATION Over 200 axial-flow pressure fans, ranging in diameter from 8 in. to 10 ft., are described in a 24-page illustrated catalog issued by the DeBothezat Ventilating Equipment Div. of American Machine & Metals, Inc., East Moline, Ill.

WELDING A 4-page illustrated folder offered by Hobart Bros. Co., Troy, Ohio, discusses features of the "Transarc" a.c. welder.

LUFKIN

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